THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXII. No. 1584.] LONDON, SEPTEMBER 19, 1893. [45TH YEAR. PRICE 6d.

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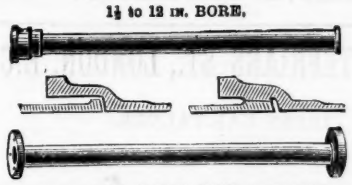

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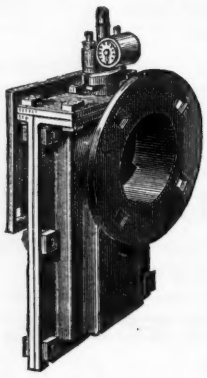

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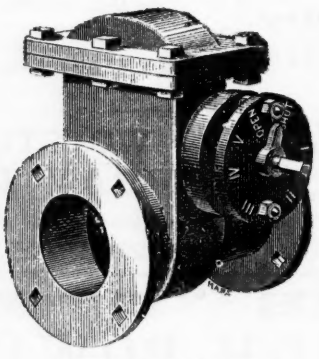

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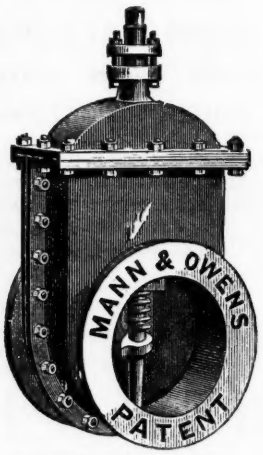

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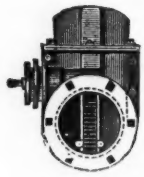

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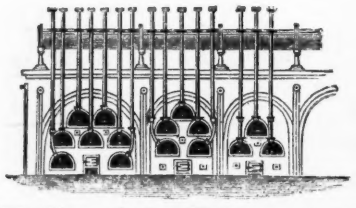

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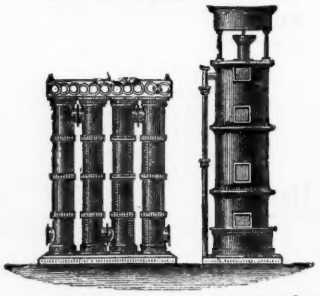

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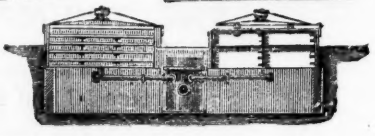

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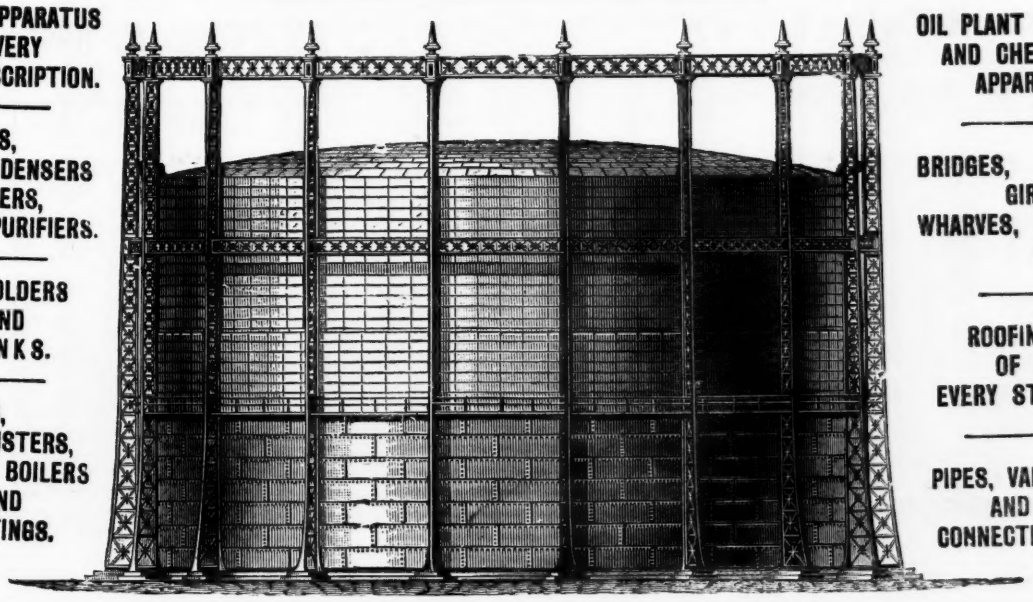

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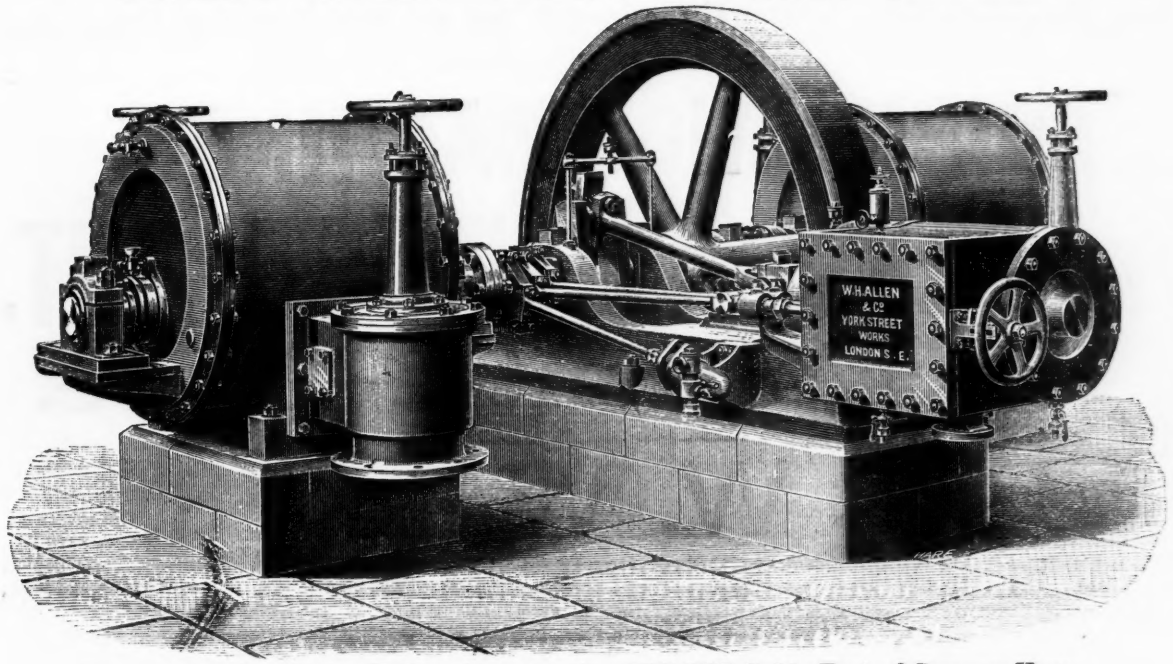

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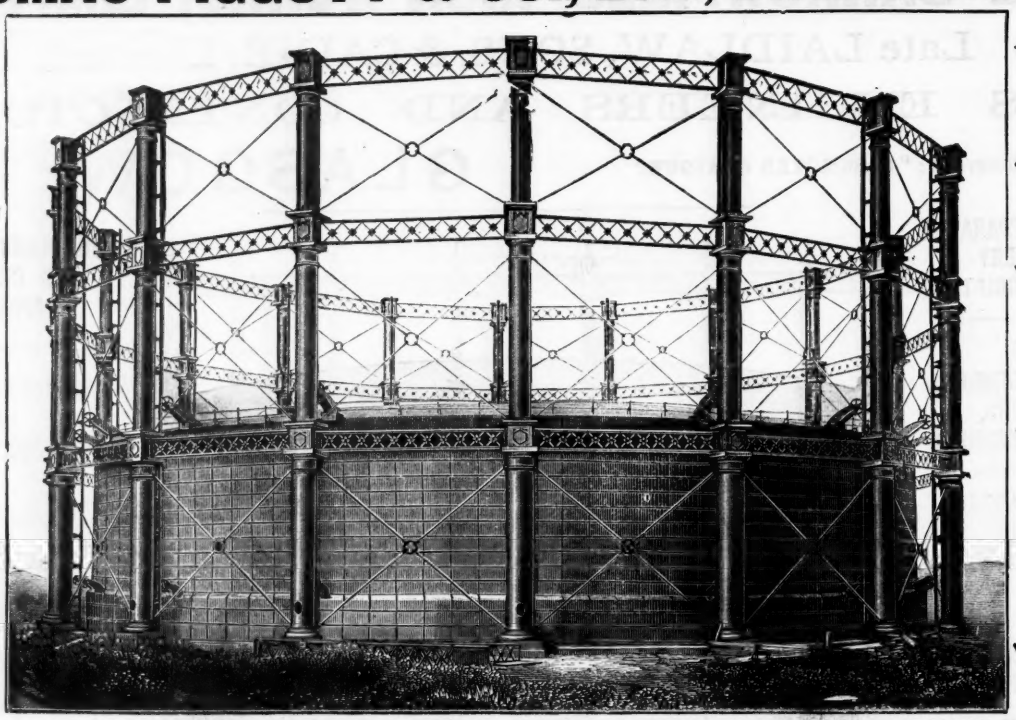

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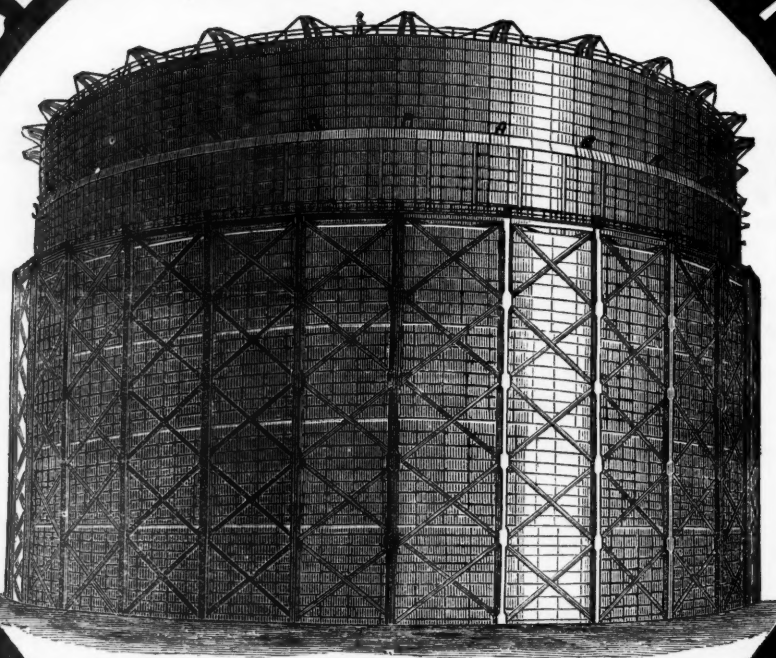

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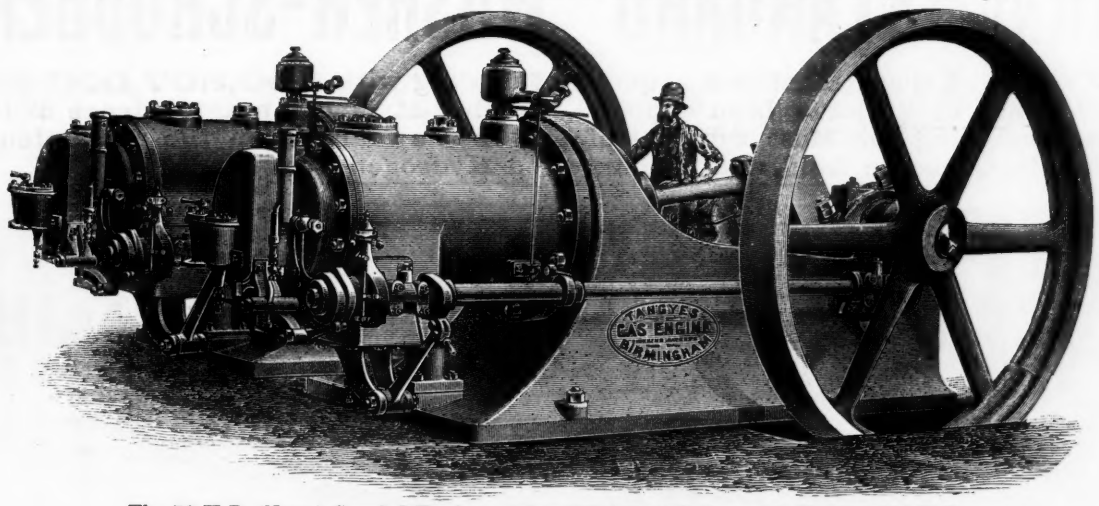

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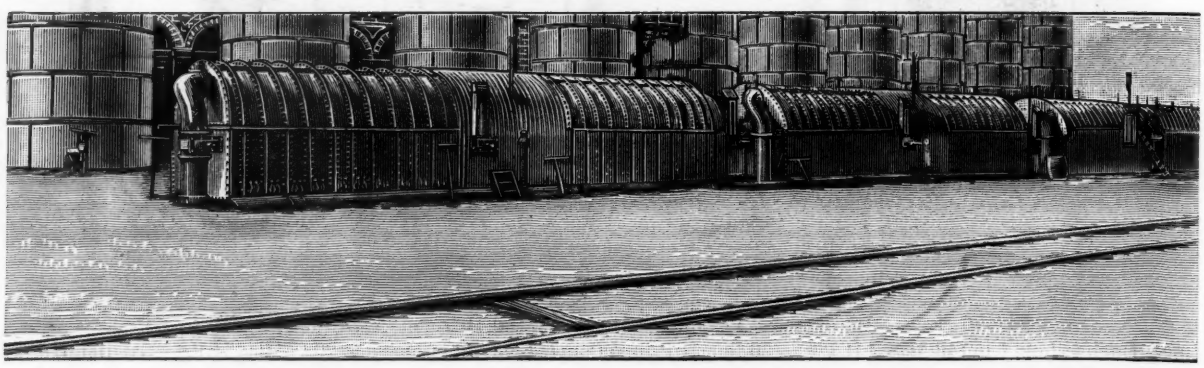

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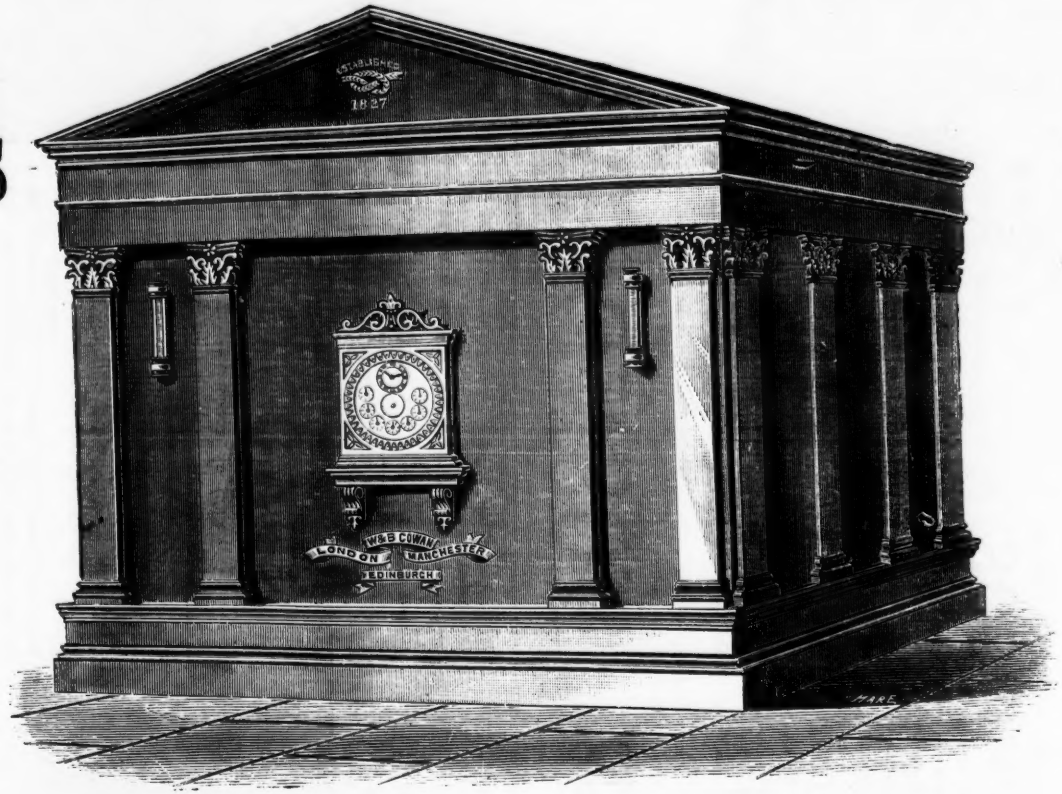

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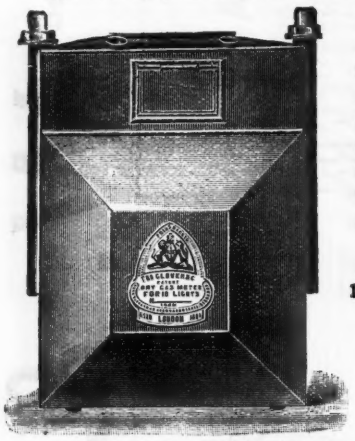

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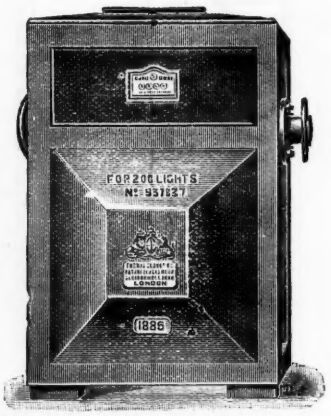

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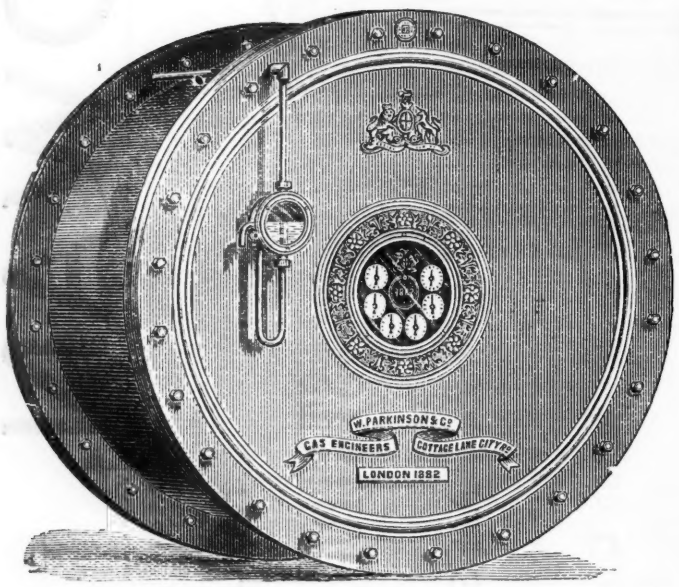

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[See also Advt., p. 564.

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TO CORRESPONDENTS.

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, SEPTEMBER 19, 1893.

The British Association Meeting—The Addresses.

THE British Association has been meeting at Nottingham during the past week; and the newspapers are full of reports of the addresses and papers read at the various sectional meetings. We have nothing to do here with the presidential address delivered by Professor Burdon Sanderson, which dealt with biological and physiological science in a style that shows a pleasing departure from the dogmatic manner of the physiologists of twenty years ago. Not the least of its excellencies is the brevity of Professor Sanderson's address, which invites busy men—more interested it may be in other sciences—to read it, in order to discover what is the actual condition of biology. Mr. R. T. Glazebrook's address to the Mathematics and Physical Science Section was mainly concerned with details; but it is noteworthy for its manful attempt to prove that Newton, while being the author of the emission theory of light, had a clearer view of the undulatory theory that was destined to supersede it than his contemporaries. Mr. Glazebrook, moreover, ventured upon a definition of light on his own account. "Light," said he, "is neither "ether nor its motion; it is energy, which, emitted from "luminous bodies, is carried by wave motion in rays, and, "falling on a reflecting surface, sets up fresh waves by "which it is in part transmitted and in part reflected." The remainder of the address was devoted to a discussion of Lord Kelvin's theory of ether in connection with Maxwell's electro-magnetic theory of light. Mr. Jeremiah Head presided over the Mechanical Science Section; and his address related principally to the connection between mechanical science and the mechanics of natural objects from which man has deduced the principles that underlie the design of his machines. Mr. Head also referred to the consequences that may result from the eventual exhaustion of the coal supply, by which man has hitherto been able to drive his most powerful machinery. Men's minds, as he said, have been set mainly on enlarging the uses and conveniences of man, and scarcely at all on economizing the great sources of power in Nature, which are being terribly wasted every day in almost all departments of their utility. The fuel stores of the world have been drawn upon to some extent for 1000 years, and extensively for more than 100 years. Authorities have given 1000 years as the possible duration of all the more accessible supplies of natural fuel; but suppose these last 5000 years, what is to happen then? Why, then, says Mr. Head, people will have to make the best of wind and water and animal motive power, and do their getting about accordingly—going to bed, of course, at nightfall. Mr. Head was decidedly pessimistic with regard to the future of the human race. Professor J. Emerson Reynolds occupied the chair in the Section of Chemistry and Mineralogy, and advocated the systematic indexing of chemical literature. Talking of a branch of the science which he called "comparative "chemistry," Professor Reynolds made some interesting remarks upon the study of carbon and silicon. Carbon, he said, is the great element of organic nature; while silicon in combination not only forms about one-third of the solid crust of the earth, but is unquestionably the most important element of inorganic Nature. The chief functions of carbon he pointed out are those which are performed at comparatively low temperatures; hence it is essentially the element of the present epoch. On the other hand, the activities of silicon are most marked at high temperatures; hence it is the element in Nature of which the chief work was done in the past, when the earth's temperature was too high for carbon compounds to exist. In the Section of Economic Science and Statistics, a strong address was delivered by Professor J. Shielding Nicholson, who selected for his subject "The Reaction "in Favour of the Classical Political Economy," and set himself to show that the traditional English political economy has neither been banished to Saturn nor stifled by Socialism, but is, in fact, stronger than ever. This was the longest and most important of the sectional presidential addresses; and, like the lectures of Professor Smithells and Professor Vivian B. Lewes, will require further attention at our hands.

Two District Association Meetings.

THE multiplicity of District Associations of Gas Managers was again illustrated in the past week, by the meeting of the South-Western at Exmouth on Tuesday, and of the Eastern Counties at Melton Mowbray the following day. Probably no two similar Associations have less to do with one another than these; and therefore the meetings on successive days at two places so distant from each other cannot be properly characterized as clashing, in the strict meaning of the term. This effect only appears in the subsidiary circumstance of its being more convenient for

us to notice the two gatherings in one paragraph. The Exmouth meeting was presided over by Mr. E. C. Riley, of Swindon, who offered some valedictory remarks of an interesting character. He is succeeded in the chair by Mr. Norton H. Humphrys, of Salisbury, in which city the next meeting of the Association is to be held. Covering such a wide extent of country as it does, it is inevitable that this Association should occasionally be convened at what to many of the members must be out-of-the-way localities; and although Exmouth is almost the same as Exeter for convenience of railway service, it can hardly be deemed a central spot, even for the western counties. This fact must be held to account for the small attendance on Tuesday last. Nor was the programme particularly attractive, from the technical point of view; the business consisting of a deferred discussion upon Mr. W. Stagg's paper, read at the previous meeting, and the reading and discussion of a short paper by Mr. S. W. Durkin, of Southampton, entitled "Notes on Main Laying"—a subject which, with all respect be it said, is as hackneyed as that of stoppages in ascension-pipes. However, Mr. Durkin did his best for his audience; and the topic is one that lends itself easily to conversational discussion by gas managers. What seemed to be a noteworthy feature of this meeting was the official reference to the proposed convention of delegates of District Associations for the consideration of the Federation idea propounded by Mr. D. Irving, of Bristol. We have since been informed, however, that this gathering cannot be arranged for as yet—a circumstance which renders comment upon the proposal unnecessary for the present. The Melton Mowbray meeting was in all respects creditable to the Eastern Counties Association, although the President, Mr. W. Duesbury, of Cambridge, was prevented by indisposition from discharging the duties of the chairmanship. His place was taken for the time being by Mr. C. E. Jones, of Chesterfield. The Association was welcomed to the town, and the members were hospitably entertained, by the Chairman of the Gas Company, Mr. G. Fitton, and by Mr. Greaves, in the name and on behalf of the Company. A short paper on "Gas Purification" was read by Mr. J. G. Hawkins, of Spalding, whose work in connection with this subject is well known. Mr. W. H. Manwaring, of Lincoln, also read a paper on "Gas Cookers," which deserves high praise as an excellent composition by a young member of the profession. The subject is not novel; but novelty is not to be wholly commended as an object of first essays in this order of literary work. Mr. Manwaring so redeemed the topic by his method of handling it, however, as to place his paper in the front rank of memoirs suitable for District Associations of Gas Managers. The new President is Mr. W. J. Carpenter, of Yarmouth.

The Coal Strike—At Blood Heat.

With the disappearance, in the smoke of incendiary fires and military fusilades, of the pretension that unrestrained Trades Unionism means peace and order, the strike of the Federation miners entered last week upon a new phase. Every Englishman must regret that it has been necessary for English soldiers to shoot English working men in order to make the law respected; but it is only what has been done before, and may have to be done again in the interest of the community. There cannot be a shadow of doubt in the minds of reasonable people, uncommitted to either party in this deplorable strike, that the prime responsibility for the blood that was shed at Pontefract rests upon the agitators, who have deluded their dupes among the miners into the belief that everything done in the name of their fetish Trades Unionism is lawful. Where were Pickard and Woods and the rest while the victims of this delusion were dying at Pontefract? Talking—at Belfast or somewhere else. Such men can always talk, if they cannot do anything more. Meanwhile, the country sees with amaze what comes of filling the heads of ignorant, famished men with crude socialistic renderings of economic considerations. The Socialist orator tells the half-starved striker that he is wronged by his employers. The poor fellow believes it, and proceeds to take vengeance in his own way; and then the soldier's bullet settles the question, so far as he is concerned. The magazine rifle has a long range, and a bullet from it can penetrate several strikers one after another if they stood in line; but there never was a rifle made yet with a range long enough to reach a Trade Union official when a row is on and the military are at hand. The sharp lesson of Pontefract has not been thrown away; but the example of the men who were shot down there, in the midst of their folly and rage, has saved scores of lives and untold value in pit property elsewhere. Meanwhile, by an overwhelming vote recorded at the end of the week, the men on strike have again refused to accept a reduction of wages, to go back to work at the old rates, or to submit to arbitration the difference between themselves and the coalowners. They refuse the last simply because they know beforehand they would lose their cause. It is a sad and a terrible thing that all this should be; but what can be said or done to end the existing division? There is no common ground between the contending parties upon which the most amiable of peacemakers can take his stand and hold out a hand to each, which is rendered clear enough by the circumstance that no offer to mediate has yet been made by anybody. The employers say that wages have been, and must continue to be, governed by selling price; and the men, by their socialistic leaders, declare that if this has been true in the past, it shall no longer be, but that prices must be regulated with reference to the payment to the miners of a "living wage"—meaning the rate paid up to last month in the Federation district. Far be it from anybody to deny to the miner his "living wage." Over and over again have we professed in these columns an ardent desire that market prices, not merely of coal, but of iron, cement, coke, gas, tar, and everything else, not excluding lucifer matches, could always be maintained at such a level as to enable everybody concerned in trade to "live and let live." Unhappily, the desire for this consummation has never seemed to us to be sufficient for bringing about the result. With socialistic agitators, on the other hand, to say a thing ought to be, according to their views, seems to be the same as having it so; and thus men of the Mann and Tillett type go on asserting that the world is governed after quite different principles from those which really obtain. They, and others like them, have precipitated this Federation strike with the deliberate intention of pitting words against facts, cries against prices, wishes against circumstances, dreams against realities. It is hardly doubtful how the strife will end; but the cost! Many of those who live through it may have cause to regret that the swift mercy of the Lee-Metford bullet was denied to them in the beginning.

The Sheffield Gas Company's Meeting.

The proceedings at the last ordinary general meeting of the Sheffield United Gaslight Company are chiefly noteworthy as exhibiting how the same influences that have affected the recent course of the gas industry in London and elsewhere have operated upon this undertaking. Sir Frederick Mappin presided over the meeting; and we are glad to recognize in his reappearance on this occasion a proof that his health is in a fair way of restoration. The Chairman drew attention to the success of the new policy of the Directors, in providing for raising additional capital by the cheap method of issuing debenture stock. The Company evidently acknowledge the special obligation that lies upon them to procure whatever new capital may be required for the undertaking at the lowest possible cost, seeing that they must be compared by local opinion in this respect with the great neighbouring towns where the gas-works belong to the Municipalities. It is this consideration that gives the gas undertakings of Liverpool and Sheffield their peculiar interest in the eyes of students of gas politics. The publicly-owned gas undertakings in the North of England are obliged to pay off their capital indebtedness, which is a course denied to Gas Companies; and the effect of this difference of financial principles must be to make the municipal works compare advantageously with the Companies in the matter of capital burden. Fortunately for the latter, the Local Authorities rarely refrain from laying hands on the gas profits in aid of the rates; and this tends to equalize prices. There has been a slight falling off in gas consumption in the Sheffield district; and the return from the chief residuals shows a decline. It is an instructive illustration of the truth, so often expounded in these columns, that the problem of increasing and extending the popularity of gas in every town must be approached with due regard to local circumstances, that, in replying to a question about the possible introduction into Sheffield of the prepayment meter system, Sir F. Mappin was able to

state that more than half the meters used there are of the "two-light" size. With 28,000 such meters fixed in the district, it is clear that the Company have already tapped that stratum of consumption which other undertakings have been induced to take exceptional measures for reaching. It would be interesting to learn what is the average yearly rental earned by these small meters, which are so commonly employed in manufacturing towns, and how it compares with that commanded by the "penny-in-the-slot."

Gas-Fires—Wanted, a Coin-Freed Tap.

In our "Correspondence" column will be found a suggestive letter on the subject of safety atmospheric burners for gas-fires, which we are pleased to welcome as an indication of the interest taken in the improvement of this class of fittings by consumers and men of scientific education outside "the trade." The writer treats of a point of burner construction of which users of gas-fires take a good deal of notice. Of course, we cannot tell whether or not he has really succeeded in curing the weakness of "lighting back," which is a troublesome complaint; and it is quite likely that he will be told by experienced persons that his fancied discovery is no discovery at all, but is only an unintentional copy of what others have done before him, or would have done if the thing had been worth doing at all. It is certain, however, that atmospheric burners intended for use in connection with gas-fires or for any other household purpose are commonly disliked by nervous and fastidious people because they "bang," or light back and smell offensively, and assert themselves unbearably by persistent singing in a chamber where perfect quiet is a *desideratum*. This distaste does not prevent such goods from being purchased and used in enormous and increasing numbers; but this is not the point.

Gas engineers solicitous for the permanent popularity of gas for heating and cooking—especially the former—would fain feel that the last reproach had been lifted from the indispensable atmospheric burner, and that it had become something, if not exactly to be liked, at any rate unobjectionable. At present there is no denying that the gas-fire, notwithstanding all that has been done in the way of decorating it with pretty tiles and fine iron casting, is rather endured as the lesser of two evils than truly loved on its own account. It is handy, clean, and (if prudently managed) not ruinously costly; but—there is always a "but"—it is regarded as a makeshift. Its insistent noise—albeit its voice may be still and small—is too trying for the nerves of highly-strung individuals; and many brain-workers would sooner bear with the occasional rattle of making up a coal fire than live with the most "improved" gas-fire which is never silent. Then the flavour of acetylene is to most people the vilest of abominations; and the best-conducted atmospheric burner is apt to smell of it at times. Naturally the makers of gas-fires are inclined to ignore these complaints; but their permission is not requested by the popular writers—prominent among whom is Mr. Ashby Sterry—who have the public ear, and do not hesitate to express the deepest hatred of gas-fires for reasons similar to those here given. We should like to be able to meet these gentlemen on equal terms, and convict them of speaking from prejudice; but, unfortunately, it is with gas-fires as with lighting burners—those who criticize in the hearing of the public insist on taking the worst and least efficient specimens as representative. There is only too much reason to fear that, so long as gas-fires can be found that sing, bang, or smell badly, so long will these failings be held up in the popular eye as characteristic of the whole type of such appliances.

Meanwhile, that there are reasonably efficient gas-fires to be had, we hasten to admit. And here we desire to lay before all whom it may concern a suggestion that has reached us with regard to the facilitation of the introduction of these aids to comfort in apartments where they are not likely to be found in the ordinary course—to wit, hotel bedrooms. It is asked why somebody does not bring out a coin-controlled gas-fire for fixing in hotel bedrooms, whereby the cold and weary traveller might help himself to an hour or two of warmth, if he desires it, without all the trouble and delay of getting a fire lit to order. It would not be necessary to invoke the "penny-in-the-slot" meter in this case, but rather to make the coin set free a cock, seeing that all the gas would be passed through the house meter. The suggestion is not without point; and although the amount of gas consumption to be secured in any such way might not be large, there would be something gained in exhibiting gas as the traveller's friend.

WATER AND SANITARY AFFAIRS.

Probably a greater or more unwelcome surprise never befell the London County Council than the report of the Royal Commission on the Metropolitan Water Supply, presented to Parliament last week. One sentence of that report scatters to the winds all those accusations against the character of the supply which the County Council and their officials have either promulgated or endorsed. The Commissioners say: "We are strongly of opinion that "the water, as supplied to the consumer in London, is of "a very high standard of excellence and of purity, and that "it is suitable in quality for all household purposes." What now becomes of Mr. Binnie's declaration, contained in a report printed as a pamphlet by the Council, and in which we read: "It is evident that the inhabitants of "London are living under conditions as to their water "supply which might lead to an outbreak of epidemic "disease that, for extent and severity, would be almost "unparalleled in the history of the world"? Such a notion was, of course, readily espoused by the Council, as it served to depreciate the value of the property held by the London Water Companies, and harmonized with the schemes for bringing water to London from Wales or Cumberland. The quality of the water being now vindicated, the next consideration is as to quantity. According to the County Council, the water supply of the Metropolis must speedily and permanently prove deficient, or the Thames and the Lea must be seriously reduced in volume. In fact, both these rivers, but especially the Lea, were declared to be already unduly drawn upon by the Companies, besides which the verdure of the Lea Valley was alleged to be suffering from the excessive drainage of the subsoil. An extension of the storeage system, by means of large reservoirs to be constructed above the intakes, was declared to be impracticable. The Royal Commissioners, in accordance with their instructions, have gone carefully into these matters; and they find that, in the watershed of the Thames and the Lea, sufficient water can be obtained to furnish a daily supply of 35 gallons per head to a population of above 12 millions, or nearly a million in excess of what the total population of Greater London will have become in 1931, even if the ratio of increase in the last decennial period to 1891 is fully maintained. Reaching yet farther into the future, the Commissioners say they are of opinion that a large supply of water may be obtained from the chalk area in the basin of the Medway and the district to the east, without any risk whatever of damage to that area.

As might be expected, the Royal Commissioners point out the methods by which the supply of water to the Metropolis is to be maintained in purity and quantity. They recommend an increase in the number of sewage farms, these to be frequently inspected by an authority appointed for the purpose. They advise that the Thames Conservancy Acts should be amended; and the powers of the Conservators enlarged, comprehending the full length of the tributary streams. Similar recommendations apply to the Lea. An actual watershed authority, with complete power of inspection, seems to be the ideal entertained by the Commissioners; and, so far, the project is the revival of a plan advocated many years ago in a minority report laid before Parliament. So wide a jurisdiction, or something approaching to it, would necessarily involve an extensive staff and large current expenditure. It is proposed that this expense should be borne by the Water Companies, and such other bodies as are permitted to take water from the rivers. The celebrated Manifold Ditch is the subject of special reference, and we may hope that its purification will be thereby hastened. An extension of the powers and duties of the Official Water Examiner is also contemplated, for the purpose of enforcing some fresh regulations as to the treatment of the water after it has passed into the Companies' works. Seeing that the Commissioners speak highly of the water "as supplied" at the present time, we may presume that these recommendations with regard to the Water Examiner are mainly due to the fact, of

which the Commissioners say they are well aware, "that "a certain prejudice exists against the use of drinking "water derived from the Thames and the Lea, because "these rivers are liable to pollution, however perfect the "subsequent purification either by filtration or artificial "means may be." We may remark that the *Globe*, in a leading article, quotes this passage in a manner which makes it appear as if the "prejudice" was in agreement with the views of the Commissioners. Certainly we do not so understand the words; neither could such an interpretation be reconciled with the strong approval of the supply expressed in the preceding sentence of the report. The Commissioners, as we apprehend, simply wish for every possible guarantee to be given to the consumer that he is having a pure and wholesome supply. For this purpose, it is proposed to increase the assurance that what is already being done by the Companies will be carried on in the future, and will be extended as occasion may require. Part of the operations will consist in drawing an enlarged supply from the wells in the chalk. The plan which the Commissioners propose, with regard to the works and the development of the entire supply, has the merit of being a gradual development, so as to meet the wants as they arise, instead of plunging headlong into a huge expenditure.

The report thus presented carries great weight from two circumstances. In the first place, it emanates from a Commission admirably chosen and highly qualified. In the next place, the report is unanimous. Considering the sustained bitterness of the attacks made on the Companies and the supply, it would have been no great marvel if divided counsels had marred the final result of the inquiry. But this is not the case. Neither is there any "trimming" in the report. The conclusions are clear and emphatic, and are the more worthy of confidence seeing that they have been arrived at in full view of the fact that cholera is in some mysterious way threatening our borders. That the report of the Royal Commission will put an end to controversy we do not expect. The County Council will not be so easily baulked of their prey. They asked for a Government inquiry; and it has been granted in the highest form. That they will now be satisfied would indicate a change in spirit and policy which we dare not anticipate. But assuredly the report of the Royal Commissioners will not enable them to drive a hard bargain with the Companies.

Inasmuch as there are many Water Companies who, though in the dividend list, have not yet attained the dignity of the "statutory maximum," it is pertinent to give some further consideration to the dividend question which was briefly alluded to in our issue of the 5th inst. Upon such a matter, it is certainly expedient that some uniform principle should be adopted, in so far as it does not clash with the plain meaning of any special enactment. Unfortunately, however, the advantages of uniformity were not in times past sufficiently appreciated by parliamentary authorities; and the consequence is that the Special Acts of different Water Companies contain provisions as to the allocation of dividends which are open to many and various interpretations. Section 75 of the Water-Works Clauses Act, 1847, provides that the profits to be divided between the undertakers in any year shall not exceed the prescribed rate, or where no rate is prescribed, shall not exceed 10 per cent. per annum on the paid-up capital, "unless a larger dividend be at any time necessary "to make up the deficiency of any previous dividend "which shall have fallen short of the said yearly rate." It is safe to say that the Companies who have had to adjust their finances with reference to this last proviso, are few and far between. The Portsmouth Water Company (whose undertaking the Local Authority recently proposed to purchase) is, we believe, one of the few concerns which have already returned something to the proprietors in the way of "back-dividends." There are plenty of younger Companies, however, whose first issue of capital was to carry a 10 per cent. dividend, if earned, who have subsequently made issues at 7 or 6 per cent.; and to those who have the management of such undertakings, the question of proportionate allocation of profits must needs be, or will presently become, of considerable moment.

It is to be remembered, too, that Companies having a reserve-fund are empowered, by sections 76, 78, and 79 of the General Act above-mentioned, to take from the fund such a sum as, with the actual divisible profits of the year, will make up a dividend at the prescribed rate, "from "time to time as occasion shall require." These general provisions, where incorporated with Special Acts, are supplemented by the variegated legislation to which we have already referred. Thus, in the case of the Kent Company, it is enacted that, where in any half year the net revenue applicable to dividend shall be insufficient to pay the full amount of the maximum rate of dividend to which each class of ordinary stock or shares is entitled, a rateable deduction shall be made in the dividend of each class. The New River Company's Special Act passed in the year 1854 does not incorporate the dividend sections of the General Act of 1847; and beyond the provision for converting their bond debt into a permanent 5 per cent. debenture stock, it contains no express provision as to dividend. By the Company's Act of 1866, the issue of certain new shares was authorized; and these shares, it was enacted, were to carry a dividend *pari passu* with the shares of the original proprietors. The East London Water Company have an Act which provides that in case of new shares having a guaranteed or preferential dividend, the rate of such dividend is not to exceed 5 per cent. per annum. A subsequent Act, authorizing the issue of additional capital, contains no express provisions in respect of dividends. The Southwark and Vauxhall Company's Special Act incorporated the dividend section of the General Act. They have a 10 per cent. issue, and a 7½ per cent. issue; but there are no special provisions as to the adjustment of dividends where the maximum is not available for each class. The West Middlesex Water Company, among other Acts, have an Act framed in 1860, which authorizes an issue of new shares, preferential or otherwise, "provided that, if in any "year the profits are not sufficient for the full amount of "the preferential dividend for that year, the deficiency "shall not be made good out of the profits of any subse-"quent year, or out of any other funds of the Company." The Grand Junction Company have an Act (1878) which places the question of dividends on a clear and intelligible basis. It is enacted that, if in any year the net revenue is insufficient to pay the full amount of the prescribed dividend on each class of ordinary stock or shares, the revenue shall be applied in the first place in payment of dividend on all the ordinary paid-up capital up to 7 per cent., and next of a further dividend up to 10s. per cent. on the ordinary capital of the Company created under previous Acts; and the balance in payment of a dividend upon the ordinary paid-up capital entitled to a higher rate than 7½ per cent. The Lambeth Company and the Chelsea Company have no Special Acts which, on the question of dividend, call for observation.

Even from the foregoing notice, brief though it be—and, of course, space forbids any ampler quotation from the numerous Special Acts—it is manifest that much diversity reigns in regard to the dividend regulations of the London Companies. As to the Provincial Companies, it is impossible to offer any precise information; but there is too much reason to believe that here, too, diversity of enactment is not one whit less pronounced. The truth is, in such matters, the individual views of Parliamentary Agents have been allowed unfettered scope. To remedy the difficulty, and remove the doubts which thus arise, would be a notable and useful achievement; but it is to be feared that it is out of the question. Yet it is well that attention should be directed to the subject, so that when a Water Company hereafter goes to Parliament for power to raise additional capital, the apportionment of dividend where the profits may not prove equal to the maximum rates all round, shall be expressly and explicitly provided for. Meanwhile, great as is the respect due to an opinion given by Mr. Buckley, Q.C., it must, of course, be understood that the learned gentleman's views are not necessarily of general application. Mr. Buckley had to interpret the mandate, so far as concerns distribution of dividends, of the South Essex Water Company. But other Acts may involve a different construction; and, though the barrister who has advised the South Hants Water Company on the question of equalization and priorities, is at one with Mr. Buckley, it must be remembered that Counsel's views by no means invariably coincide. Mr. Fooks, Q.C., the Chairman of the South Essex Company, is not convinced by what his brother-in-the-law advises; and he did not hesitate to tell the shareholders what he thinks on the subject, and why he thinks it. Who then shall be sure, when lawyers disagree?

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 554.)

THE course of affairs on the Stock Exchange during the past week has been uneventful and unimportant. The settlement was a very light matter, and was satisfactorily got through. The general complaint is that there is so little business doing. The revival of confidence and activity which has so long been looked for, and often thought to be almost in view, still remains unattained. The ultimate result of the solution of the Silver Question is so difficult to foresee, that most prefer to hold their hands and await the issue before entering into any fresh commitments. But if there is little buying, there is little selling; and really good stocks are scarce and dear. Many believe that there is a good time coming, and that it is not far off; but we must get to the end of the troubles already referred to. The dark cloud of the coal strike, too, is as black as ever, and is doing immense mischief to trade. The value of money fell steadily; and on Thursday the Directors of the Bank of England saw their way to restoring the 4 per cent. rate, after a three weeks' period of 5 per cent. Business in the Gas Market continues to be much the same as it has been for the last few weeks. Transactions are decidedly restricted; but so far from there being any sign of weakness from want of support, the tendency to increasing firmness is most marked. This is especially the case with the chief issues. In Gaslights, there was moderate business done in the "A" stock, which opened at 227, and gained fractionally every day, until the closing mark on Saturday was 231. The secured issues were rather quieter; but they commanded good prices, though at the same time they made no actual advance. The scarcity of South Metropolitans tended to send the prices of all three issues up; but business in them was still very restricted. A little business was done in Commercials at good figures. The general meeting is convened for the 5th prox.; and no change in the rate of dividend has been announced. The Suburban and Provincial Companies were almost wholly neglected, and presented no feature. The Continentals were very quiet; but what business was done in them showed their general firmness, while Imperial advanced a couple of points. Among the rest, Bombay recovered the ground it lost a few weeks ago, and Malta made an advance; but Brazilian affairs had the effect of throwing San Paulo back. The Water Companies were more active; and they all made some improvement, with the exception of Grand Junction, which slightly receded.

The daily operations were: Gas was quiet on Monday; transactions being almost confined to Gaslight issues, which were firm and unchanged. There was even less doing on Tuesday, but prices rose. Imperial Continental gained 1; and both Bombays, ¼. Grand Junction Water fell 1½. Wednesday's transactions were very limited; and the only moves were an advance of 1 in Gaslight "A," and of ¼ in Malta. Prices remained extremely firm on Thursday, but quotations did not move. Further progress was effected on Friday by an advance of 1 each in Gaslight "A" and Imperial Continental. Business was quiet on Saturday; but changes were important. South Metropolitan "A" and "C" rose 3 each; ditto "B," 2; while a general advance was made in Water stocks, as set forth in the list on page 554.

ELECTRIC LIGHTING MEMORANDA.

The Electric Lighting Industry in a State of Suspense—The Municipalization of Electric Lighting in the United States—The Chicago Electrical Congress and Light Standards—An Incandescent Arc Light.

THE electric lighting industry in this country seems just now to be in a state of suspense, awaiting the expiration of the incandescent lamp patent, which is expected to cause a great revival of trade. This is the third epoch-making event in the annals of the industry in Great Britain, if we except the popularization of the arc lamp by Jablochkoff, and the introduction of the incandescent system of lighting, from which the industry may be said to have taken its rise. The first of these epochs dates from the passing of the Electric Lighting Act of 1882, and the second from the amendment of this statute—both events having exercised a marked influence upon the conduct of the industry. Whether the advent of the eighteenpenny incandescent lamp is to restore the hopes of electricians to the high pitch they attained ten years ago is as yet doubtful. But it may at least be conceded that this is the last economical boon they have in sight; and if it fails them, the future will be dark indeed. It is admitted that nothing worth mentioning is to be looked for in the direction of improvements in electrical generating plant; while as regards the possibility of reducing the cost of power for driving it, the electrical industry is in the same box with every other manufacturing interest. Nothing better than the incandescent lamp as a means of transforming electrical energy into light has even been suggested; so that when this appliance is placed upon the market at an ordinary commercial margin above the cost of production, it will be the last word of the electrical industry upon the economical side of the question of its adaptability to the wants of the community. It may be supposed that, when the lamps are cheapened, there will be fewer of them in use exhibiting blackened bulbs, and filaments emulating the brightness of a freshly blown-out wood match; and this will be a satisfaction so far as it goes.

In the current number of the American *Engineering Magazine*, there is an article by Mr. M. J. Francisco, bearing the somewhat indefinite title of "The Fallacy of Municipal Ownership." Such a name for a magazine article might mean anything; but, as employed by Mr. Francisco, it simply refers to some considerations of detail arising in connection with the ownership of electric lighting plants by United States local authorities. It appears that American electric lighting companies are aggrieved by the claim of the advocates of municipalism that electric lighting is supplied by local authorities at cheaper rates than by companies similarly situated; and Mr. Francisco sets himself the task of disproving this allegation. He declares that "not an instance can be shown where municipalities have furnished the lights at a less cost than private companies, if all the expenses are considered and the facts are candidly stated." It appears from the latter part of this statement that there is the same difficulty on both sides of the Atlantic in ascertaining all the facts of the working of a municipal department. Mr. Francisco asserts—probably in order to show that electric lighting companies in the States do not charge too much for their services—that such concerns do not in reality charge enough; and he adduces in support of this contention the fact that 33 out of 56 electric lighting companies doing business in Massachusetts did not pay any dividend last year, while the average dividend paid for the year by the whole 56 companies was only 0·0235 per cent. He asks triumphantly: If private companies, with all their skill and close business management, can barely pay expenses at current rates, how can municipalities be benefited by engaging in the business? The query is of more than local application. Mr. Francisco goes on to observe that where a municipality owns a lighting plant "there are many ways by which the cost can be reduced apparently, besides the practice of true economy. Officials see no necessity for inaugurating strict business methods when a plausible statement that there is a reduction satisfies the public." Well may the writer remark that "human nature is the same the world over." He might have added that there is a good deal of human nature in the personality of local self-governing bodies. Again, there is a familiar ring about the statement that "many cities have been induced to adopt municipal ownership under false impressions. Then councilmen were deceived by statements regarding the cost." There is no need to follow Mr. Francisco through his proofs of this assertion, drawn from Transatlantic experience. We have the same sort of thing at home.

It is reported that the International Electrical Congress, which has been in session at Chicago in connection with the Exhibition, has passed resolutions adopting the principal electrical units of measurement generally employed throughout the civilized world. This is a compliment to the civilized world which it is to be hoped will be duly appreciated. At the same time, we learn that the Committee appointed to consider the subject of a standard of light were unable to recommend the adoption either of the amyl-acetate or the pentane lamp as satisfying the requirements of the case. In other words, the electricians assembled at Chicago, representing either themselves or the scientific associations and Government departments that sent them as delegates to the congress, have demonstrated once more the incapacity of such bodies to advance the matters to which they devote their attention one iota beyond the point at which they have been previously carried by individual workers. It is not surprising that such a knotty matter as the selection of an international standard of light has proved to be out of the power of a congress of electricians, wherever assembled; and it is likely that the failure of the Chicago assembly in this regard will be as balm to the souls of the perplexed members of the Board of Trade Committee now plunged in the almost hopeless task of endeavouring to perform the same service for London, with single reference to the necessities of gas testing. The United States is one of the countries which have not yet taken the grave step of adopting a national standard of light. Several European nations have done so, and not one of them thinks well of the standard of its neighbours. It is easy to discover fatal objections to any standard of light hitherto proposed; and meanwhile the perfect one, which might have a chance of uniting in its favour the suffrages of the scientific men of all nations, still keeps obstinately out of sight.

Many attempts have been made, without much success, to bridge over the gap that lies between arc and incandescent lighting. Small arc lamps have been put upon the market from time to time, only to be withdrawn after a season, without explanation from the parties interested in pushing them; and from the other side a determined approach has been made by high-power incandescent lamps to the peculiar position occupied by the ordinary arc lamp. Indeed, it is argued by some electricians that, with the single exception of lighthouse work, powerful incandescent lamps are capable of doing practically all that arc lamps can do at but small additional expense, when the cost of attending upon the latter is taken into consideration.

It is admitted, for the purpose of this argument, that the ungovernable brilliancy of the ordinary commercial arc lamp is a nuisance, and that a unit of light not exceeding 150 or 200 candle power is usually strong enough for all practical purposes. This is a contention with which gas engineers will have no difficulty in agreeing, inasmuch as it is the very position for which they have been struggling ever since they gave up making 1000-candle power lanterns with the object of beating arc lamps on their own chosen ground. A fresh attempt has been made to modify the arc lamp, with a view to extending its applications, by Mr. L. B. Marks, who has submitted to the Chicago Electrical Congress what he calls an "incandescent arc light;" this being essentially an ordinary carbon arc arrangement enclosed in a glass case which has a valve opening outwards, but not admitting air. When the arc is started, the enclosed air in the case is soon deprived of its oxygen, and an atmosphere of highly-heated carbonic acid and carbonic oxide gases is produced, in which the carbon vapour issuing from the arc is maintained in a state of incandescence. The proper conditions being fulfilled, the lamp is said to maintain its maximum efficiency shortly after the current has been passed through it, and glows like a solid cylinder of white light. The phenomenon is described as very beautiful indeed—the source of light being apparently as large as the glass case. But the net result, apart from a claimed economy of carbon, is indistinguishable from that which might be produced by an opal shade; that is to say, the dazzling brilliancy of the naked arc is dispelled.

The Destruction of Cholera Bacteria in Water-Mains.—In the *Zeit. fur Hygiene*, Herr Stutzer lately described some experiments he had made on the action of very dilute sulphuric acid when used in water-mains for the destruction of cholera bacteria. An abstract of his remarks is given in the Proceedings of the Institution of Civil Engineers. The author previously satisfied himself, by practical tests, that a solution of 0·05 per cent. of free sulphuric acid was fatal to cholera bacteria in a quarter of an hour, and repeated the experiments with percentages of acids varying in strength from 0·01 to 0·05 per cent., and obtained corresponding results. The 0·02 per cent. solution needed 24 hours, but the 0·03 per cent. solution was fatal in five hours. A few colonies escaped an hour's exposure to a 0·03 per cent. solution; and a few preserved their vitality after a like exposure to a 0·04 per cent. solution. But all the bacteria were destroyed, as before, by a 0·05 per cent. solution, even in a quarter of an hour. As the action of this weak acid upon the disease germs was thus proved to be very energetic, it appeared that it might be employed to disinfect the service-pipes, if it did not attack the metal too strongly. In order to test this point, the author obtained from the Bonn Water-Works some specimens of pipes in ordinary nse. He concludes that it is possible, by the use of this very dilute acid, to speedily destroy cholera germs without any noteworthy injury to the pipes; further, that in the case of rusty pipes a mechanical separation of the incrustation takes place. He believes also that it is probable that algæ and other vegetable growths, and even animal substances contained in them, would be destroyed.

The Danger of Disused Service-Pipes.—Perhaps there is no practice more common than that of leaving service-pipes in premises after the supply of gas has been discontinued. In most cases, when a tenant leaves a house, or ceases to be a gas consumer, the service is simply disconnected from the meter, and the end closed by a plug or a cap. That the practice, common though it is, is not without danger, is proved by an accident which has recently happened in the Lancashire town of Bury. An old man has lost his life through being poisoned by the gas which escaped from a disused service-pipe and filled his dwelling-house. Fortunately, he was the only inmate, and was thus the only victim. The service-pipe was of iron, ½ inch in diameter; and it appears to have been laid in the usual way horizontally from the main, and then vertically to a sort of coal-hole under the stairs, where the meter was placed. Why gas-meters should be fixed in all sorts of out-of-the-way inaccessible corners is one of those problems which may some day be worthy of consideration. In this case, gas had not been supplied to the house since 1890; and meantime no one, we may be sure, ever gave a thought to the old service-pipe. When it came to be examined after the death of the occupier of the house, a hole was found in it through which gas was escaping. The whole of the exposed portion of the pipe was greatly corroded; and to this cause, combined with the rough usage which it would be likely to receive in contact with the coal, is attributed the fracture. Mr. Malone, the Outdoor Superintendent of the Corporation Gas Department, gave evidence at the inquest that it is in Bury, as elsewhere, the custom to leave the service-pipes in houses after the supply of gas is cut off, and that this was the first time in his experience where the portion of the pipe actually in the house had been found to be corroded, though he admitted that iron service-pipes suffer very greatly from this cause. The jury found the only possible verdict under the circumstances, in deciding that the death was due to misadventure. They might, if they had had any knowledge of the subject, have added a recommendation that gas should be cut off from houses in some more 'safe and scientific way than by simply plugging the end of a pipe.

THE UTILIZATION OF TOWN REFUSE FOR FUEL OR GAS MAKING.

Nor the least interesting or important passage in Professor Kennedy's masterly exposition of the present state of knowledge in regard to the utilization of energy, the chief points of which were set forth in the two last numbers of the JOURNAL, is that in which he briefly considers and disposes of the suggestion to use dustbin refuse as fuel for the generation of the energy required for the lighting of our towns. The idea has been mooted in connection with several proposed practical applications; and it may be remarked that Professor Robinson has pledged himself to do something in this way for the benefit of the St. Pancras Vestry when dealing with the pending extension of their electric lighting undertaking. Time will show whether Professor Kennedy or Professor Robinson is right in estimating the amount of assistance to be expected from dustbin fuel in this regard. The subject is worthy of the attention of gas engineers for several reasons, especially since it may be remembered by some members of the profession that town refuse has been brought before now into notice as a possible gas-making material. Twenty or thirty years ago, several schemes were proposed for working gas-retorts in connection with sewage disposal; and experiments were made to show the feasibility of the idea. Curiously enough, a series of articles by Mr. Thomas Tomlinson upon the utilization of town refuse for power production has just appeared in the *Electrical Review*, which, starting with the consideration of dustbin refuse as a fuel for steam-raising, finishes up with an account of a retorting process which recalls the exploded gas-making projects already referred to.

The discussion of this subject of economical rubbish disposal raises at the outset the difficult but unavoidable question of what is a primary and what a secondary or residual product. Modern industry teems with examples of the interchangeability of these classes of products; that which is the principal object in some manufacturing processes being at best a residual, and at worst a troublesome waste product of another industry. Thus, in the gas supply of towns, the gas is the main thing intended to be produced, and to it, if necessary, everything else must be sacrificed. On the other hand, in coke making, the gas is of small account; while in coal carbonizing works for the production of benzene, &c., neither gas nor coke governs the manufacturing processes nor the economics of the trade. The question of what is the staple and what the residual product in these cases needs to be carefully answered; and the answer must never be forgotten or obscured by false considerations, or else the observer of such processes is led into accepting such fallacies as that which has troubled the minds of many would-be gas supply reformers, who have believed that gas ought to be provided for next to nothing where the residuals nearly pay the prime cost of the coal carbonized.

Thus, in commencing the discussion of town refuse utilization, either as a manure, or as a fuel, or as a gas-making material, it is imperative to keep in the forefront the requirement that the refuse must first be disposed of satisfactorily. This is a point to be pressed home to the members of local authorities who have the responsibility of dealing with the matter. For reasons which need not be entered into here, the cremation, or incineration of town refuse is recommending itself very strongly to municipal authorities at the present time. There is no difficulty in doing this by proper apparatus. But in the process a good deal of heat is generated and apparently wasted; and much of this heat comes from gas that strikes the casual observer as too good to waste in this way. Consequently, it is perfectly natural for local authorities to ponder the possibility of so utilizing at least a portion of this heat or this gas, or both, as to reduce the expense of collecting and disposing of the refuse. Municipal engineers are therefore likely to be asked questions on the subject; and it is desirable that they should form the clearest and most definite ideas as to the real value of this waste heat or gas. The most obvious use for the surplus heat of a refuse destructor is to make steam; but this can only be properly done if its initial purpose is in no wise impaired. Unless this condition is observed, the result will be bad in both ways, and the "combined" plant will resemble most "combination tools" in being good for nothing.

Many lecturers and writers of papers have framed estimates of what can be done, by way of electric lighting and otherwise, by appropriating the waste heat of refuse destructors; and Mr. Tomlinson passes in review the statements in this regard of Professor Forbes, Mr. G. Watson, and others. The former laid it down, in the course of his Cantor Lectures at the Society of Arts, that if the refuse of such a parish as Paddington were properly burnt, and the heat utilized in the most economical way, there would be enough to supply the whole quantity of electric light required by the population, supposing this kind of light to be used as freely as gas or oil—that is to say in the proportion of one lamp per head. Mr. Tomlinson works out the data underlying this assertion, which he finds to be tenable only as a statement of remote theoretical possibility; and after making due allowance for all reasonable probabilities of realization, he finds it to be "more than nine times untrue as the expression of fact on which an engineer can calculate now." Yet

this estimate has been put in circulation among members of local authorities as though it represented the facts.

Mr. Tomlinson handles the St. Pancras project of Professor Robinson with really conspicuous tenderness. In this instance, 66 indicated horse power are expected per ton of refuse burnt, which is 10 per cent. in excess of Mr. Watson's claimed results for Oldham; whereas Mr. Tomlinson thinks that Mr. Watson's figures must be reduced. At Hastings, where the Jones cremator is used, 40 indicated horse power are obtained per ton of refuse. Professor Robinson, moreover, expects to obtain 16 indicated horse power continuously for each cell destroying 6 tons of refuse per 24 hours. This is just four times as much as the plant at Ealing is doing now. Messrs. Bramwell and Harris have in hand an extension of the Ealing plant, in which it is contemplated to burn ashbin refuse and sewage sludge mixed, with an anticipated duty of 8¼-horse power continuously per cell consuming 6 tons in 24 hours. It will be instructive to see how St. Pancras fares when the new scheme is put into operation. Certainly, if the facts do not bear out Professor Robinson's estimate, there will be an "unpleasant quarter of an hour" for this enthusiastic projector.

Mr. Tomlinson's articles conclude with a description of a sewage destructor designed by Mr. John Hanson, of Wakefield, in which the familiar gas-retort reappears from its obscurity of a quarter of a century. It is only fair to Mr. Hanson, however, to state that the conversion of sewage into illuminating gas does not enter into his arrangements. The plant consists of a cast-iron circular retort, 6 feet long by 19 inches in diameter, closed at one end by a luted lid, and having an outlet (on top in the middle of its length) to which is connected a pipe that at first rises to a height of about 18 inches above the retort, then goes to the back of the setting, s returned to the front through the furnace which heats the retort, and then returns again into the ash pit, where it opens underneath the fire bars. The flue goes from the retort-setting into one-half of the fireplace of an ordinary vertical steam-boiler which stands close by the setting; the other half of the grate being left for a fire in the ordinary way. The action of the apparatus is simple enough. The retort-furnace is lit, and the retort made hot, at the same time that a fire is kindled in the half of the boiler reserved for the purpose. It should be premised that a pipe from the boiler is led as an injector into the pipe from the retort at the point where the latter turns to pass through the furnace. The only purpose of the boiler, in fact, is to supply this injector. It will now be understood that a charge of refuse being put into the retort and sealed up, and the steam turned into the outlet-pipe, the mixed steam and gas resulting from the drying of the stuff are drawn off, and caused to pass through the furnace fire. After starting, it is found that the riddled refuse from the dried charge is sufficient to keep the retort hot; while the heat from the retort-setting is quite enough to retain steam in the boiler. In an account of an experiment continued from the 21st to the 23rd of August, when nearly 7 tons of refuse were destroyed, Mr. Tomlinson says that the trial ended with a bright fire in the retort-furnace, none in the boiler, and 30 lbs. of steam. The first two cartloads of refuse treated were "pure midden stuff, and fearfully wet;" and the remainder were of the same nature, but altogether drier and lighter. After the charges were drawn from the retort, they were riddled to remove tins, bottles, &c. The combustible matter formed only 54 per cent. of the whole.

When it was attempted to make illuminating gas from sewage sludge, &c., it was found that, apart from the low illuminating value to be obtained from such stuff, unless it happened to be exceptionally greasy (when the recovery of the grease was more profitable than the burning of it), the charges were so damp that an enormous waste of fuel was entailed in their distillation. It is a different thing, of course, if the gas resulting from such distillation is only required to assist in heating the retorts, in which case it might be profitable to condense and wash it first. We fear, however, that both Mr. Hanson and Mr. Tomlinson have overlooked, in their desire to secure the economies of a retort as compared with the destructor system, the higher cost of labour in the case of the former. So far as the question of labour is concerned, it is a step backward to go from the destructor cell to the retort. The service of a garbage-distilling retort-house would be objectionable and laborious to a degree; and it may be doubted even if the adoption of inclined retorts would materially help the matter forward. At least they might be tried; and as inclined iron retorts might be quite filled with dustbin refuse, they would probably work satisfactorily.

To be perfectly frank upon this much-debated subject of the utilization of dustbin refuse, we cannot say that we entertain any great expectations of a really economical solution of the problem, whether the material is cremated, retorted, or dealt with in any other way. Nobody thinks it contains the elements of value as a manure; and burning it is by far the most sensible way of getting rid of what is perishable, and at the same time noxious, in its composition. As Mr. Tomlinson says, if any of the heat resulting from this process can be converted into use, well and good; but in this case the heat is merely a residual. It is not available at the time, in the place, or in the manner that might warrant its treatment as a marketable commodity The heat of a rubbish destructor cannot be compared with the heat that resides in a bag of coals, for the latter can be conveyed to wherever the heat is wanted, and be burnt as required; whereas we must go to the destructor if we want any heat from it, and take it as we can get it. It so happens that gas engineers have intimate knowledge of what might be called waste heat, and of how little it is worth. The retort-settings of every gas-works must necessarily be worked at such a high temperature that a great deal of the heat of the furnace gases passes off unutilized by the retorts. In the case of a large gas-works, the apparent waste of heat from this cause is enormous, quite throwing into the shade the wastefulness in the same respect of refuse destroyers. Yet although the first attempts of the callow gas-works economist are frequently devoted to the thankless task of trying to do something with the waste heat of the benches, the experienced gas manager leaves it alone. It is there, it is true; but it is not worth catching. If waste heat were like anything tangible, or were capable of being stored, it would be worth collecting, just as so many residual fluids and solids of manufacturing processes are collected and stored. Being what it is, however, it is almost as vain to think of catching a superfluity of it for ulterior use, as it would be to trap the sunbeams of this glorious summer for reproduction in the dark days of the coming winter.

LEVYING AND COLLECTING RATES IN MANCHESTER.

An agitation is being carried on in Manchester for a reform in the system of levying and collecting the rates. One of the ends at which its promoters aim is the appointment of a central rating authority, which shall have the power to adjust the municipal burdens and remove certain anomalies which now exist. If this were their only object, little fault could be found with the agitators, for there are seventeen boards of overseers levying and collecting rates in the twenty townships into which the city is divided; and of late much scandal has been caused by the discovery that, as between one township and another, the rates vary as much as 2s. 8d. in the pound. In Openshaw, the amount of the rate levied is 4s. 4d.; while in the adjoining township of Bradford it is 7s. Various explanations of the difference have been put forward; and, if this were the place for it, an interesting article might be written on the inadequacy of most of these theories. However, the City Council have been induced to consent to an inquiry into the matter; and the possibility is that some day a scheme will be matured for rate equalization. The main contention of those who call for this change is that the poorer townships should share in the relief created by the larger rateable values existing in other townships. Former dwellers in the city have now been driven into the suburbs because their houses have been destroyed in order to make way for warehouses, offices, and shops; and the not unnatural argument used is that the city ought to bear its share of the extra burden cast upon the suburban districts because of this change. But this argument does not meet the whole case, as abundantly appears from the fact that the two townships of Bradford and Openshaw, already referred to as offering a striking contrast in the matter of rates, are both among recent additions to the city, and are both inhabited by a similar class of people, carrying on like or kindred industries. However, the matter is not for discussion here; and the report of the Finance Committee, when it comes, will no doubt throw much light on the whole subject.

Still there is an aspect in which the question has an interest for us. A "plank" in the "platform" of one of the numerous parties which endeavour to make themselves heard at election times is: "One staff of collectors for all purposes." This seems the corollary of any attempt at the equalization of rating. But the two things are not necessarily connected; and a considerable advance might be made in either direction without any corresponding progress in the other. At present the city rates, poor rates, and other imposts, are collected by the officials of a score or so of boards of overseers; and, in addition, the Corporation have their collectors for various purposes. They have a large staff who look after the rentals and other accounts of the Gas Department; there is another staff who receive the rentals, &c., of the Water Department; and there are collectors for other purposes. On the face of it, then, there is nothing unreasonable in the suggestion that much time and labour now wasted, and not a little expense unnecessarily incurred, might be saved. It is solely a matter of organization. One man could collect from the ratepayers of a certain area all that is due to the Corporation for rates and for gas and water rentals. The area would have to be restricted, no doubt; and whether the monetary saving would be as great as some people expect may be open to question. Still, there is no reason why half-a-dozen rate collectors—a *genus* which a natural history professor the other day compared to a platypus, because it is "a beast with a bill"—should be treading on each other's heels the year round. In the Manchester Gas Department last year, the cost of collection was £7255. This would seem to be the actual expense of collection, and to be independent of all accountants' work except that of the cashier. There are 26 ordinary collectors, receiving as salary and commission from £147 to £299 each. Besides these, there is a collector of miscellaneous accounts, a cashier, and various receivers of rental in the office. Six of the collectors were paid salaries exceeding £299; but none had quite £300. Four received from £280 to £289; nine, from £214 to £268; six, from £167 to £199; and

two, £147. Then in the Water Department there are sixteen collectors receiving among them £3211; besides which there is an office receiver with a salary of £300. In this case, too, £300 is the high-water mark of such salaries. There is one collector who is paid a salary of £296; another receives £269; five have from £200 to £250; six, from £150 to £200; three, from £140 to £150.

These facts are being used not only as arguments for the amalgamation of the various collecting departments, but as part of an agitation for what is euphemistically described as "the reconsideration by the City Council of the salaries and duties of the higher officials." Someone has been at the trouble to extract and publish, from the Treasurer's accounts, a list of all the officers receiving £150 a year or more. By including a number of collectors and others who are having less than this amount, the compiler has brought his total to the respectable sum of £56,000. As he has arranged the names and amounts in a sort of descending scale, without any classification of the duties that are performed, he has succeeded in producing the effect which he no doubt intended—namely, that very large sums are being paid in salaries, and that the ratepayers get a doubtful return. Looked at in detail, the matter has an altogether different appearance. In the Gas Department the total receipts for the past year were £555,564; and the net profit, after paying interest and the contribution to the sinking fund, was £64,792. The total salaries paid amounted to £11,136; including superintendent, managers of four stations, deputy-managers, superintendent of street mains and lighting, accountant, chief clerk, principal rental clerk, chief meter inspector, deposits clerk, and all the much-abused collectors. Leaving the collectors out of the reckoning, there is a total of £3581 paid in salaries. For the actual management of the works, the salaries were £1451; and, having regard to the fact that the make of gas last year was 3634 million cubic feet, the Corporation can hardly be accused of extravagance in this direction. Even the cost of collection, large though it is made to appear, is not excessive, if it is compared with the amount collected, to which it seems to bear the ratio of only 1½ per cent. The total salaries in the Gas Department work out to just 2 per cent. on the total receipts. In the Water Department the position is similar, though in the matter of salaries the Water Committee are rather more generous than the Gas Committee. The amount paid under this head, exclusive of collectors, was £4690, as against £3581 in the Gas Department. The several salaried officials are: General outdoor superintendent, indoor superintendent, general inspector of mains and services, clerk to Water Committee, office receiver, engineer, deputy-engineer, engineer's principal assistant, principal bookkeeper, assistant general inspector of water-mains, inspector of rates and rentals, chief rate clerk, general inspector of service fittings, mortgage clerk, tester and stamper of fittings. Adding the remuneration of these officers to that of the collectors, we have a total of £7900 for the salaries of this department. This is rather more than 3 per cent. of the revenue of the department, and is thus 1 per cent. more than the Gas Committee pay for superintendence and collection. A difference of 1 per cent. would probably not have much effect in an agitation against salaries; and it is not likely that very much will be made of this fact, if, indeed, anything more than a "storm in a teacup" should come of the whole controversy. The people who are trying to excite feeling on this question rely more upon broad effects than upon trifling differences of light and shade. They are therefore not at all likely to bring into prominence the fact that in two of the departments of the Corporation the receipts amount to three-quarters of a million sterling, and that the proportion which the "high salaries" bear to this amount ranges from 2 to 3 per cent.

The William Livesey Testimonial Fund.—We are informed that the subscription list of this fund will be closed at the end of the current month.

East London Water-Works Company.—At the meeting of this Company on the 5th prox., the Directors will recommend a dividend at the rate of 8 per cent. per annum for the half year ending June 24 last; leaving a balance of £7767.

The "Vertmarche" Regenerative Gas-Lamp.—The proprietors and manufacturers of this lamp (Messrs. H. Greene and Sons), had it on view at the annual exhibition of the Royal Cornwall Polytechnic Society, held at Falmouth from the 5th to the 9th inst., where it gained the highest award for gas-lamps—a silver medal.

Five-Figure Logarithms.—We have received from the publishers (Messrs. E. and F. N. Spon) "A B C Five-Figure Logarithms for General Use," by Mr. C. J. Woodward, B.Sc. This little book first made its appearance a few years ago, and was noticed in the JOURNAL at the time; and the reason for the re-issue is explained by the author in his preface. The original work contained mantissæ of numbers only; and immediately after its publication, it was suggested that it would be a convenience to have logarithms of arc functions arranged according to the same or a similar method. The present work is the outcome of many trial schemes to effect this object; and it may be commended to all who use logarithms in their daily routine of calculation.

NOTES.

Diamonds from Coal Gas.

M. Gustave Rousseau recently communicated to the *Comptes Rendus* a remarkable statement, referring to his experiments upon the cyclical condensation of carbon. It appears that, in the course of some investigations into the nature of certain manganites, cobaltites, and ferrites, M. Rousseau obtained some metamorphoses which led him to the discovery of a new phenomenon in chemical physics—that is to say, the so-called cyclical transformations to which can be subjected a particular radical under different temperatures. Thus certain compounds of manganese and soda can be formed at a given temperature, changed into something different by raising the temperature, and finally reconverted into the original compound at a still higher heat. From these analogies, M. Rousseau thought that, if hydrocarbons were heated through the range of temperature between bright red and 3000° C., there might be produced in turn the various isomeric states of carbon, each of which presents its own degree of stability according to its place in the thermometric scale. It is known that the hydrocarbons form amorphous carbon by decomposition at red heat; while all varieties of carbon are transformed into graphite in the voltaic arc. M. Rousseau claims to have established the novel fact that carbon presents the cycle graphite-diamond-graphite in an interval of temperature comprised between 2000° and 3000° C. He worked with acetylene to solve this problem, because this carbon compound has a certain stability at high temperatures, and is endowed with a marvellous plasticity, besides polymerizing easily into a series of carburets more and more condensed. Acetylene was heated in an electric arc furnace, producing both black diamonds and graphite. The experiment was of a difficult character; and much acetylene escaped treatment. M. Rousseau says that the hydrocarbons of coal gas can be made to furnish acetylene, under the action of heat; and in one experiment of 40 minutes' duration, he was able to obtain 20 milligrammes of black diamond in this way: He caused a current of illuminating gas, saturated with the vapour of benzene, to pass into a hollow block of quicklime, where the voltaic arc was maintained. Unfortunately, owing to the leakiness of the furnace, the gas burnt; and after two hours' heating, he could only find a small quantity of graphite mixed with some grains of carbonado. M. Rousseau proposes to continue these experiments, with a furnace hermetically sealed, and constructed of refractory material not containing carbonates. He also intends to substitute for coal gas the highly condensed carburets derived from coal tar or petroleum residuum. Whatever may be the further outcome of these experiments, it is of interest to record that diamonds have actually been made directly from coal gas by simple heating under ordinary atmospheric pressure.

Tests for Carbonic Oxide in Air.

Various reagents have been proposed as indicators of the presence of carbonic oxide in the contaminated air of a room, such as may be due to the imperfect combustion of gas or the use of a closed heating-stove, &c. Haberman has demonstrated that cuprous chloride constitutes an excellent medium for the quantitative determination of carbonic oxide in air; and he has designed a form of apparatus for using it for the purpose. Chloride of palladium has also been recently indicated as an excellent reagent for the same object. If shaken up with air containing carbonic oxide, the latter gas reduces the palladium salt; and the result is a dark brown precipitate. The last suggestion to the same effect is to use ammoniacal nitrate of silver, which is very simply prepared by adding ammonia to a solution of the nitrate until only a small proportion of the oxide of silver remains undissolved; the fluid being then filtered and kept for use in a well-stoppered bottle. It remains without alteration for many months, even though exposed to direct sunlight. A sample of suspected air shaken up with this preparation gives a distinct brown coloration, if only one-tenth of 1 per cent. of carbonic oxide is present; the colour deepening with an increase in the proportion of the gas, until with about 5 per cent. brown clouds appear, and 10 per cent. gives a brown precipitate. Pure air treated in the same way does not give the slightest coloration. It is not claimed, however, that the test is specially advantageous for quantitative determinations; the power of the silver preparation for absorbing carbonic oxide being in reality limited.

Transparent Films of Platinum.

Some interesting experiments carried out by Dr. G. B. Rizzio, and described by him to the Turin Academy of Sciences, have resulted in adding one more link to the chain of experimental correlations between light and electricity. By taking a number of precautions against oxidation, Dr. Rizzio succeeded in depositing transparent films of metallic platinum upon the interior of glass cylinders, with which he proceeded to make observations for the determination of transparency at different temperatures. These cylinders were placed in iron pipes in a small gypsum furnace, and heated by a spiral tube of small gas-jets. Light was transmitted through windows in the iron tube, and a Krüss universal spectroscope was used to compare the spectra of the beams which passed through the glass and

platinum, and through the glass only. The temperatures were measured by the calorimetric method. After allowing for the various reflections undergone by the light, it was found that as the temperature rose the transparency of the platinum began to increase, especially in the more refrangible region. According to the electro-magnetic theory of light, both the resistance and the transparency of a conductor should increase, and the resistance and transparency of a dielectric should diminish with a rise of temperature. So far as these experiments go, therefore, they give results in perfect agreement with this theory.

A Large Gas-Engine.—A gas-engine, which is stated to be the largest yet made, has been erected by Messrs. Fielding and Platt, of Gloucester, in substitution for steam-engines to drive the whole of the machinery in their works. It is a tandem engine of 200 indicated horse power; and it is driven by Dowson gas. An important feature is the starting gear, which enables the engine to be started against two-thirds of the full load. It is said to be perfectly safe, as only compressed air is stored, at 50 lbs. per square inch; and no explosion takes place except within the cylinder.

Chimatto Enamel.—We have been afforded, by Messrs. Fletcher, Russell, and Co., Limited, of Warrington and London, an opportunity of judging of the effect of the treatment of the surface of cast-iron by the new process they have recently introduced. A small cast-iron boiling-burner has been coated with Chimatto enamel, which, the firm claim, effectually prevents rust, while lending itself to the decoration of all kinds of ironwork. Any number of colours, either dead or bright, and both silver and gold, dull or polished, are, it is stated, obtainable on the same casting; and they do not change with exposure to air or to any heat up to a bright red. The film of enamel is so thin that the smallest details on the metal are unchanged. As castings protected in this manner are not only capable of fine artistic treatment, but are proof against dirt and smoke, the enamel should find extensive use.

Cement Manufacture in China.—In the last British consular report from Tientsin are described the works for the manufacture of Portland cement, which are situated at Tongshan, 80 miles from Tientsin, and were erected three years ago. The plant is of the most modern description. The raw materials used are mountain limestone, fire-clay, marl, and a rough kind of china clay, all of which are found in the immediate neighbourhood of the works. The fuel used is hard furnace coke, made on the premises from the local bituminous coal. The process of manufacture is somewhat more elaborate than that adopted in the Thames works; much greater care and attention being necessary to ensure the production of good Portland clinker. Nothing but true clinker is ground at the Tongshan works; and the resulting cement is of great density—158 lbs. per bushel. The present output is 300 tons per week; and this is the limit of the capacity of the works. It is all used at the various works of the Imperial Government—harbours, forts, the Yellow River embankment, railways, arsenals, &c.—very little finding its way into the hands of private consumers. There is every probability that the demand will soon be largely in excess of the existing works. The cement is guaranteed to stand a tensile strain of 400 lbs. per square inch after having been immersed in water for seven days. In fact, it invariably tests much higher. For some time considerable difficulty was experienced in obtaining cement of uniform quality. But something like system has at last been established; and the work technically proceeds with the utmost satisfaction—the output being as uniform in quality as it is possible to obtain anywhere.

The Improved Welsbach System of Incandescent Gas Lighting.—Readers of the JOURNAL will be aware that several improvements have been effected in the Auer incandescent gas-light since its introduction, some few years ago, by Dr. Auer von Welsbach; but it may not be inopportune at the present season to refer briefly to them. In the first place, the durability of the "mantle" and its consequent value as a light-giving agent, has been greatly enhanced by certain changes which have been made in its constituent elements. A further improvement consists in the method of supporting the mantle; this being now done by a central pin instead of from the side as formerly. These alterations add to the efficiency of the burner, and enable it to compete with the various ordinary and high-power burners and lamps now in the market. This it is doing successfully, both in England and on the Continent. With the Welsbach system, coal, water, or oil gas may be employed; and it is adapted to exterior as well as interior lighting. In the former direction, great progress is now being made. Strong claims are put forward for the Auer incandescent gas-light, on the grounds of economy, healthfulness, and efficiency; but they appear to be fully justified by the results of a series of tests made by Professor Renk, Director of the Hygienic Institute of the University of Halle-on-the-Saale, to which reference has already been made in our columns (*ante*, p. 123). The Incandescent Gas-Light Company, Limited, are making lamps in a variety of tasteful designs; and with the view of meeting the increasing demands upon them, and of facilitating comparison and selection, they have enlarged their factory and show-rooms in Palmer Street, Westminster, and have opened a branch establishment at 33, Queen Victoria Street, E.C.

TECHNICAL RECORD.

SOUTH-WEST OF ENGLAND DISTRICT ASSOCIATION OF GAS MANAGERS.

The Half-Yearly Meeting of this Association was held last Tuesday at Exmouth, under the presidency of Mr. E. C. RILEY, of the Great Western Railway Gas-Works, Swindon. The attendance of members was not quite up to the average; but the weather was all that could be desired, and a very pleasant day was spent. Luncheon was provided early in the afternoon at the Imperial Hotel; and immediately afterwards the business meeting was held in an adjoining room.

MINUTES OF LAST MEETING.

The minutes of the meeting held at Wormwood Scrubs in April last were first taken as read, excepting the one recording the two resolutions regarding the question of the federation of District Gas Managers' Associations, which was read by the HON. SECRETARY (Mr. Norton H. Humphrys, of Salisbury).

On the motion of the PRESIDENT, seconded by Mr. SAINSBURY (Trowbridge), the minutes were adopted—the former stating, with respect to the subject of federation, that it had been arranged to hold a conference of representatives of Gas Associations on the 23rd inst., at the Westminster Palace Hotel.*

A WELCOME TO DEVON.

Mr. H. F. WILLEY (Exeter) said, as a resident of Exeter, and as one who had been connected with the gas industry for nearly half a century, he had, on behalf of the gas engineers of the district, to express the great pleasure they felt at the Association again honouring the West of England with their presence. It was some time since they had given them this pleasure; and he regretted that, owing to circumstances arising from many reasons within the judgment of the Committee, the Association had not paid more visits to Devon and Cornwall. In both of these counties, there were many large works managed by men of ability; and if these visits could be extended to incorporate these gentlemen—this rather outer circle—he thought it would be wise. Therefore, on their behalf, as well as his own, he had to thank the Committee for having given them pleasure in again meeting in Devonshire; and he hoped the time would not be far distant when they would repeat this honour.

Mr. W. A. PADFIELD (Exeter) supported the remarks made by Mr. Willey.

The PRESIDENT, on behalf of the Association, briefly thanked both gentlemen for their kindly observations.

ANNUAL ACCOUNTS.

The HON. SECRETARY then submitted the accounts for the year ended Aug. 31 last. They showed that the receipts (including £1 2s. 10d. brought forward) amounted to £33 3s. 4d.; and the expenditure, to £24 17s. 3d.

On the motion of the PRESIDENT, seconded by Mr. J. H. CORNISH (Bridgwater), the accounts were adopted.

ELECTION OF OFFICE-BEARERS.

The SCRUTINEERS (Messrs. Nicholls and Osmond) reported that the following gentlemen had been elected to hold office during the ensuing year:—

President—Mr. N. H. Humphrys, of Salisbury.
Vice-President—Mr. F. G. Dexter, of Winchester.
Hon. Secretary—Mr. H. Sainsbury, of Trowbridge.
Auditor—Mr. W. Higgs, of Basingstoke.
Members of Committee—Mr. F. F. Farrand, of Ryde; and Mr. H. C. Shepherd, of Swindon.

Mr. HUMPHRYS thanked the members for the honour done him in electing him President for the ensuing year; adding that it would be his endeavour to do the best he could for the good of the Association, and to forward its interests in every possible way.

Mr. DEXTER also thanked the members for electing him to the important post of Vice-President.

Mr. SAINSBURY observed that the Committee had requested him to take the secretaryship for twelve months, while Mr. Humphrys held the office of President. He had no doubt Mr. Humphrys would give him any assistance he required; and during the time the duties were in his hands, he would do the best he could for the Association.

The PRESIDENT remarked that he was exceedingly pleased with the elections that had taken place. Mr. Humphrys had done a great deal of hard work for the Association; and he was glad the members had, in their wisdom, seen fit to confer upon him the honour of President. As to Mr. Dexter, although a young member, he had always been anxious to do what he could to make the meetings useful by reading papers.

THE SPRING MEETING.

Suggestions having been invited as to the town at which to hold the spring meeting,

Mr. HUMPHRYS said, in accordance with precedent, it would give him very much pleasure if the members would do him the honour of holding the meeting in Salisbury; and he would do

* Mr. Humphrys has since informed us that he has "found it impracticable to arrange for this meeting."

all he could to make the visit an enjoyable one. It was nearly ten years since they met in Salisbury; and he was desired by Mr. Hardick to say that he quite looked forward to once again receiving the Association there.

Mr. WILLEY (who had previously made the proposition, and now withdrew it, that the meeting should be held at Torquay) seconded the motion, which was unanimously carried.

PRESIDENTIAL REMARKS.

The PRESIDENT then addressed the members as follows:—

Since I had the pleasure of welcoming the Association to Wormwood Scrubs in April last, two of the most important matters of general public interest that have had a special and direct relation to the gas industry have been the remarkable long-continued dry and hot weather of this most exceptional summer, and the unfortunate coal strike that has done so much to dislocate the trade of the whole country—the former resulting in a much smaller consumption of gas, and the latter causing a certain amount of difficulty and anxiety in obtaining the raw material gas managers have to work with. In referring to the latter, I think it is not only permissible, but extremely desirable, that Associations like our own should express a very decided opinion that it is important that some method of dealing with great conflicting questions between capital and labour should be established which would afford a basis for equitable investigation and decision, which would prevent an industrial war injurious and, to a certain extent, dangerous to the community at large. I know the question of official and authoritative arbitration in industrial questions is surrounded by many difficulties; but, if the obstacles can be overcome in important international disputes, I can scarcely believe that the resources of the statesmanship of the Nineteenth and Twentieth Centuries would fail even here.

I have been strongly impressed for some time, from the variety of lighting arrangements to be found over the extensive system of a great Railway Company, that gas managers should regard themselves as *competitors* for the provision of light, heat, and motive power with rivals who have special spheres of usefulness under certain circumstances that commend them to users in many important points, and not in any sense as *monopolists*. And, if the adoption of gas extends proportionally to what we believe its advantages and value entitle it, managers must be prepared to make some effort and take some trouble to show how gas can be most advantageously and attractively applied. The two great rivals we all recognize are petroleum and the electric light; and I think I have correctly placed them in the order of the extent of their adoption. I will illustrate this by some instances that have come under my own notice. The first was a case of outdoor lighting over a large area; and estimates were obtained for lighting with petroleum and gas respectively. In regard to the former, lamps which were rated at 200-candle power were specified, and their value calculated on a certain consumption of oil per hour; and, on this basis, the cost of a given quantity of light was able to be arrived at. A separate estimate of the prime cost of the installation was also supplied. In the case of gas, the same method was observed. A given number of lamps of 150-candle power were specified at a certain consumption of gas per hour, and, in the comparison, the 200-candle power petroleum lamps came out the cheapest—*i.e.*, comparing the cost per candle as they had been rated—and were consequently adopted. After the new lighting had been in use a short time, some disappointment in the result was evidently felt, and comparisons to the disadvantage of the oil-lamps were made with nominally 150 and 100 candle power gas-lamps at other places; and eventually one of the petroleum lamps was sent to be properly tested by a photometer, with the result that an average maximum of only about 45-candle power was obtained with the best procurable oil. The makers were unable to credit this result, and were invited to send their representatives to be present at some further tests, and provide their own oil and lamp-trimmer. This was done; but with the same result, except that on one occasion, with the wick specially saturated by hand, and trimmed abnormally high, a light of 79 to 80 candle power was obtained for about five to seven minutes, and frequently the average light was only 25 candles. I think, without any further comment, that the misleading character of the comparison referred to will be seen, and that the nominally cheaper light was only giving about 20 per cent. of the light specified in the estimate which obtained petroleum the installation. A further inquiry as to the grounds on which a result of 200-candle power was claimed in the estimate elicited the reply that the burners were purchased in Birmingham, and the makers or vendors called them 200-candle power burners. The other illustration I will give has reference to the electric light. A large company, having a private works for their own gas supply, obtained a very fine installation of the electric light, with the result that the quantity of gas required from their own works was reduced by from one-third to one-half; but, since the completion of the installation, from various causes—such as the extended use of gas for special industrial processes, and for the avoidance of the cost of the provision of day current when the work on the dynamos would be so unprofitably light—the consumption of gas has quietly and steadily grown, so as to have nearly attained the same figure as before the electric light was provided.

It appears to me that the moral of these illustrations is that gas managers should take every opportunity of showing the real value and usefulness of gas, and special efforts should be made to adapt its use to special purposes such as automatic water and other kinds of heaters, as well as the provision of lamp fittings or apparatus specially designed to meet some peculiar or unusual requirements; and thereby establish the conviction that, in some form or other, gas is essential to civilization in its higher development both of industrial efficiency or personal or domestic comfort. One other instance I will just mention is the case of an underground establishment, which was somewhat difficult to light effectively, and which required artificial light to some extent during the whole 24 hours. An improved lamp or burner was inquired for; and, to meet the case, and endeavour to obtain the best result at the least cost, three different types of lamps were shown, and fixed temporarily for inspection and approval, and a portion of the establishment was afterwards fitted with the one most approved of the three, for a more extended trial and test. These are the lines I would venture to submit should be followed, if gas is to maintain and improve its position in face of the rivals which are so earnestly competing for a share of public favour. While alluding to the importance of adaptation to circumstances and surroundings, I should like to pay a tribute to those who have endeavoured—like Mr. W. A. Valon, of Ramsgate—to extend the use of gas in the houses of working men by the free provision of internal fittings and the prepayment meter; for, while our friend the electric light may gain customers in the castle, mansion, or grand hotel, the more democratic element we purvey should make still more rapid progress in the workshop, warehouse, and cottage.

Perhaps I should say a word in reference to the growth of oil-gas manufacture and train lighting. The low price at which petroleum and paraffin oils are now obtainable, together with the steady improvement in various processes of manufacture, are all tending to the increased use of oil gas, both for enriching coal gas for general lighting and for carburetting water gas. In train lighting, since the paper I gave at Bristol, constant and steady progress is being made, and oil gas is not only the light of the future for trains, but, to a large and rapidly increasing extent, the light of the present. Works are being erected and carriages fitted with gas at a steady and constantly growing rate; and even in Ireland, as will have been noticed by the description given by Mr. Outon at the North of Ireland meeting at Coleraine of the new oil-gas works recently erected at the Inchicore works of the Great Southern and Western Railway (as recorded in the JOURNAL OF GAS LIGHTING for Aug. 22), substantial progress is being made. There are, of course, differences in the views of railway companies as to the extent of their responsibility to the public, and especially to the third-class passenger, for providing a good reading light; and there are cases where the point of economy has been carried so far as to content themselves with merely giving a light that is a slight improvement on the old oil-lamp, with, of course, the advantage of permanence instead of occasionally burning down to a spark, and even at times going out altogether. I think, however, we may trust the onward march of improvement in the standard of railway comfort and efficiency to rectify these deficiencies, as the spirit that is leading to the provision of third-class sleeping and dining cars—where lighting, cooking, and warming is done by gas—will not allow a false economy to injure their prestige with their customers (when rivals are going forward), by restricting the light it is in their power to give. In addition to the lower price of the raw material in oil-gas manufacture, increased experience is lessening the cost of production, and leading to improvements in details of plant and methods of working, which only experience can suggest, and also in the prevention of nuisance from smell and smoke, which might be likely to cause interference on the part of the public authorities.

In conclusion, it may be interesting to those who have passed St. David's station, Exeter, on their way here, and noticed the oil-gas works now in operation at the Plymouth end of the station, to know that the building now utilized as an oil-gas works was once the engine and boiler house of the atmospheric railway which was provided for South Devon, and worked for a short time, until its unreliable character made this novel mode of travelling give way before the ubiquitous locomotive, whose speed and energy—like the light and warmth of the sometimes despised gas-jet—help to spread comfort, civilization, and peace over the face of the whole world.

The adjourned discussion on the paper read by Mr. W. STAGG (Bristol) at the meeting held in April last, was then taken. The paper was entitled—

NOTES ON THE MANUFACTURE OF GAS.

Mr. N. H. HUMPHRYS said that, to his mind, the paper presented several interesting points, which, he thought, they could discuss with great advantage. It especially commended itself as being full of facts, the results of experiments. They saw, at the beginning of the paper, that "the following notes on the manufacture of gas are, to some extent, a record of attempts made to promote efficiency and economy of working." This explained, in a few words, the object they had in meeting together. They were all concerned in promoting the "efficiency and economy of working;" and, with this end in view, they found that Mr. Stagg had been taking a great deal of trouble

in observing what was going on, and had given them the results. Mr. Stagg's paper appeared to turn chiefly on two or three points. His experiments with regard to the evaporation of liquor in the hydraulic main were extremely interesting. His experience was not that of all of them; and it seemed to him that he must work the coal at a very great heat, and the retorts must stand some little time after the charge was worked, to get the gas so hot as to dry up the liquor in the hydraulic main. His suggestion with regard to the differential gauge was a very valuable one, and one that might be acted upon to a much greater extent than it was in gas-works. They had only to connect up their gauges, and commence with a full pressure at the exhauster, and, if they found the pressure going up (say) 3 or 4 inches, they had merely to go from one gauge to another, to ascertain where the increase was. As to the question of the liquor in the hydraulic main, this was a matter in which he (Mr. Humphrys) had taken some interest; and the result of his experiments was that they had come down, not to single sections of hydraulic, but to short sections. In the paper, 40 retorts on one hydraulic were mentioned; but he did not care to have more than about 10 or 15 retorts. This saved the expense of an exhauster seal, bridge-valve, the connections, and so on, and secured all the advantages they could get with short sections. At Salisbury, with a make of 80 million cubic feet, they took up two beds at a time; and they only got the exhauster drawing on one or, at the outside, two—that was with eight or ten dip-pipes. In smaller works, with one bed, it might be advisable to keep to the single section of hydraulic; but when they came to a scale of 50 or 80 millions, they obtained all the advantages of the short section, by connecting up to two or three beds. In that district, they washed out their hydraulics with liquor; and it was a great help to do this from time to time. Some of them emptied it off every 24 hours; but he thought it better for each to observe for himself what really was best—they could not have a general rule on this point. Regarding the testing of the gas at the outlet of the exhauster, it might be in the recollection of several of those present that Mr. Garnett some years ago described to them a similar arrangement to that referred to by Mr. Stagg, by which he obtained a test of the gas as it was actually being made. This was an important matter; for it immediately showed what gas was being produced. When they had large purifiers, and the gas took perhaps over an hour to pass through, if they were making foul gas, it would not be found out until that time had elapsed. But if they had the jet photometer on the outlet of the exhauster, they would discover it at once. This was another matter of which they might take note.

Mr. F. G. Dexter (Winchester) said that, in attributing the loss of seal to evaporation (under the conditions subsequently explained), he had little doubt that the correct solution had been arrived at. But, while agreeing with Mr. Stagg on this point, he objected altogether to his experiments as being at all fitted to represent the conditions of working practice. It was essential, in making experiments intended to determine the operating causes and effects of ordinary working, that the conditions of the experiment should closely conform with the conditions of practice in every known particular. In this case, it was notably not so; and, in passing, he just wished to mention the fact—which he believed to be fairly well known—that the true temperature of the gas was really not beyond about 150° Fahr., and that the higher figure given by Mr. Stagg of about 365° Fahr. was really due to the presence of finely-divided coal dust and tarry matter carried through the ascensions by the sharp up current, and the influence of which on the experiment mentioned would be seen later on. Turning to the idea of the experimental flask, it was just possible that, through the thin glass, loss by radiation was to some extent promoted in the first experiment, although he (Mr. Dexter) certainly thought that, as in all probability the flask was placed close to, if not on, the hydraulic, these conditions more closely resembled the actual working than was latterly the case; for, by subsequently placing the flask inside the ascension-pipe, it became simply a question of determining the fact that the application of a hot current of gaseous and fine solid matter to the bottom of a flask would speedily cause the evaporation of any liquid contents, altogether apart from the like, but much less active, tendency of a fine stream of gas bubbling through about an inch seal at the surface. There could be no doubt that, whether any stream of gas was passing inside the flask or not, the whole contents, under such conditions, would be rapidly lost, as Mr. Stagg succeeded in showing. A second fault in the arrangement appeared to be this, that, while by making connections to the active plant, the proper degree of "pull," &c., was insured, yet there was no apparent indication that the relative proportions of the capacity of the hydraulic and ascensions had been repeated by similarly repeating the proportions of the tubes of the flask to the flask itself. The one acted as the ascension and dip, and the other as the hydraulic. In summarizing, Mr. Stagg admitted that the evil became intensified directly the one lot of ascensions became choked; thus throwing the greater part of the entire work on the one hydraulic of the other side. Therefore, disproportioning the flask and tubes would have at once introduced an element of uncertainty. One lesson to be learnt from Mr. Stagg's experience was the undoubted advantage of having all the hydraulics and their mountings of ample size. He (Mr. Dexter) had recently very much enlarged the hydraulics, &c., at Winchester, with very beneficial results. He also bore testimony to the great value of running not only a small stream of liquor constantly through the hydraulic, but having ample means of completely flushing out with liquor in large volume at intervals. His hydraulics were now arranged to discharge the whole contents instantly to the wells; and further, by means of an overhead tank and two 2-inch discharge-pipes from it, to rapidly scour out the hydraulic with great force direct to the wells. No deposit could remain; and, after twelve months' working, the hydraulics were as clean as when first erected. In arranging the overhead tank, he (Mr. Dexter) felt a certain risk in applying a gauge, as suggested by Mr. Stagg. It was quite possible a man would not be there when the tank was charged, and a certain blowing away of the gauge would result. He had instead put in an air-valve which instantly closed the moment the tank was full. The connections for filling were attached to the circulating-pump to the scrubber; and the moment the increased resistance occurred (due to the valve closing), the pump simply delivered on up to the scrubber distributor. Passing to the question of gauges, he might say that the differential arrangement was very useful; but, from experience, he considered intermediate gauges on the connecting mains just as necessary. Stoppages were as likely to be found there as in any apparatus. The information given under the head of carburine was very interesting; but he thought the experimental work again unfortunate. The determination of whether or not coal gas with added carburine lost any virtue at freezing temperature would be best made by photometrical work rather than the question of deposit in tubes. It appeared to be possible that, at very low temperatures, as at high temperatures, carburine might undergo some change though not necessarily a detrimental one. However, whether the deposit possessed interest from the photometrical standpoint or risk of interruption of supply, the practical value of the experiment was at once discounted by the abstraction of the water vapour with calicum chloride. With regard to photometrical value, it had already been placed on record that dried or desiccated gas possessed a higher lighting value than the commercial article; and he believed patents had been attempted for applying gas treated in this way for special cases of lighting in confined spaces. It had also been clearly proved that water vapour played an important part in causing deposition of the heavier hydrocarbons at low temperatures. For instance, naphthalene deposit was frequently brought about by the deposition of water icicles; and the frequent deposit of this troublesome matter in outside lamps had been completely stopped by first drying the gas at the foot. Consideration of these facts would clearly show that the removal of the water vapour had robbed the experiments of all useful indications as bearing upon the essential conditions of practice.

Mr. S. W. Durkin (Southampton) said he had not had similar experience to Mr. Stagg; but he might say that, from observations he had made, they had, in through settings, according to the temperature caused by the direction of the wind, very frequently a large volume of gas passing through one hydraulic and very little through the other. The point regarding evaporation was, however, quite new to him. He hoped that, if anyone had a similar experience to Mr. Stagg, he would have the matter investigated, and some test applied, with the view of preventing the recurrence of such a thing.

Mr. H. Sainsbury (Trowbridge) said he did not know whether many of the members had in use the arrangement of photometer on their exhauster to which Mr. Stagg had referred. He happened to have a photometer and purifier, as suggested by Mr. Garnett, and also a jet photometer with a regulator, so that he could see how the gas was burning, and the men could ascertain, and avoid, getting nearly an hour's bad gas through before it would be found out otherwise. He had a case only a week or two previously, when he was putting in a new bed of retorts. The seal was not quite right, and consequently it drew in a little air; but he was able to get over the difficulty before it had in any way affected the gas which had already been passed into the holders. Without this arrangement, he would have had some 5000 or 6000 cubic feet of bad gas mixed with all his good gas.

Mr. Durkin asked to be allowed to say that he was still persevering with the air process in connection with their purifying system at Southampton, and one of these arrangements of a small purifier and a jet photometer on one occasion came to their relief, and enabled them to immediately stop some mischief that was going on. Where the air process was in operation, this little sentinel in the exhauster-room was very necessary, and would frequently prove useful.

The President, like Mr. Durkin, had not, so far as his experience had gone, been confronted with much of the difficulty Mr. Stagg had had to battle with; and he had little doubt as to whether, in any well-proportioned works, the difficulty would be one that frequently occurred. He would illustrate this by referring to two works, where they had practically the same seal in each instance. He believed Mr. Stagg had not told them the exact amount of seal in his case; but, working with an average of about ¾-inch seal in these two works, in one they occasionally found the seal had been uncovered, but in the other they had been doing what had often been talked about at their meetings—that was, they had raised the hydraulic mains so as to remove them from the radiating influence of the

retort-bench, and in that way obtained increased length of ascension-pipe. This had resulted in giving them comfortable working; and no question such as that alluded to by Mr. Stagg had arisen.

Mr. PADFIELD said he had not had the trouble mentioned by Mr. Stagg with his hydraulic mains at the Exeter Gas-Works. There had been times when the illuminating power of the gas had gone down very much; and he had found that it had been wholly due to the great increase of temperature up to a given point in the works. He thought the suggestion Mr. Stagg had made was one worthy of consideration. As to enriching gas, that was a very important question; but he should like to have a few details as to the relative cost of raising the illuminating power of the gas one candle by cannel and carburine.

Mr. STAGG, in replying to the criticisms, said that Mr. Humphrys found fault with the number of retorts that had been led into one hydraulic. But he had had to deal with things as he found them; and he had given the number 40 as being an extreme case in their works. The hydraulic mains, however, were now being divided into two. Mr. Dexter agreed with him as to the results; but not in the methods by which he had arrived at them in some cases. He had referred to the drawing of the hot gas through the flask as not being in conformity with the conditions of practice. He (Mr. Stagg) saw this at the time; but it was the nearest he could get to them. As regarded the hot dust, that was a new matter to him; and it might be worth following up; but he certainly thought something more than dust was required to reach such high temperatures as he had obtained.

Mr. DEXTER (interposing) said that he believed Mr. Newbigging had once carried out some experiments, by placing a series of fine wire gauze screens in the ascension-pipes, and at the back of these he inserted thermometers, in order to determine the temperature of the gas. It was found that the moment he introduced a screen with a mesh sufficiently small to cut off the fine dust bound up with tarry matter which was passing up the ascension-pipe, the screens were very rapidly coated; but, as soon as they were removed, the thermometers registered a high temperature by these small particles sticking on to them.

Mr. STAGG (continuing) said that what he wanted to show was that the slight lowering of the seal on one side led to rapid evaporation, from whatever cause it might be, in the hydraulic. With reference to the differential gauge, he was told that they ought to have an ordinary gauge in addition. If they looked at his sketch, it would be noticed that he put one in at the beginning, which showed the pressure at the outlet of the exhauster. As regarded the carburine, the tests were made with a photometer. The gas was passed through calcium chloride, to show that it had no effect upon the carburine. His object here was to determine whether there was any deposition from the cold. There was no doubt the lower temperature would affect the gas, and would affect the carburine in the same proportion as it would the gas, even if there was no deposit. What he was trying to find out was whether there was a deposit; and there was not until it got below freezing point. In regard to the cost of carburine, he did not actually know the figure; and he could only say as he put it in his paper —that it practically resolved itself into "the difference between the extra cost of cannel over common coal against the cost of the carburine." Of course, if cannel coal was to be had very cheaply, there was no advantage directly in the use of carburine. There was, however, a distinct advantage in this way—that they could always be sure of not making gas of a better quality than they were obliged to; and, if it happened to be a little lower in illuminating power than it ought to be, it could be raised in three or four minutes.

Mr. DURKIN then read the following paper, entitled--

NOTES, ETC., ON MAIN LAYING.

In a moment of weakness, I volunteered to give this meeting a few notes on main laying; but, as most of you know all about this branch of service, it looks very much like getting up to talk out the time. In Southampton a wave of commercial prosperity has lately set in, which has tended to increase the demand for gas; and, although there is some electric lighting in the town and the docks, yet at present it has not caused my Directors to hold their hands in discharging obligations to meet the gas requirements of the district. This means the enlargement of the producing power and district mains; and this has been going on gradually for some time past.

A short description of our district may give you some idea how "octopus like" our mains have to stretch out to secure our prey. The town proper stands on a point of land—on the West bounded by the River Test, and on the East by the River Itchen, on the banks of which our works are situated. From the works we have three sets of mains running out—one set supplies the town proper; the second goes north, then eastwards to the suburbs in that direction; and the third, a 24-inch main, is taken up to a central part of the upper town, from which lateral mains diverge to the western suburbs. From this 24-inch main, I derive the text for my notes. From the end of the main in a northerly direction after leaving the town, we pass through some important residential suburbs; then into the open country; and, at about 5½ miles distance, we come to what is getting to be an important place—viz., Eastleigh—where the London and South-Western Railway Company have established their carriage works. To cope with the demand at Eastleigh Junction, the works named, and the external demand in the township, my Directors, under the advice of my esteemed friend Mr. J. Birch Paddon, determined to complete a contemplated enlargement from the 24-inch trunk main. The responsibility of carrying out the work was placed in my hands. I have had heavier work of the kind to perform, but have usually managed to drive the trunk mains without having them charged. In this case I had about 700 yards of 18-inch main to lay, and the same quantity of 14-inch to lift; and every night I had to connect up to supply the district beyond. Previous to starting, all details had to be well considered, in order to carry out the work successfully, as the road was a busy thoroughfare, and the tramway was close to us for the major part of the distance. To facilitate the temporary connecting up at the close of each day, I sketched out a plan to use two wrought 9-inch pipes, with an iron plate at each end, to be made gas-tight with india-rubber rings tightened up by screws with wing nuts. The centres of the two wrought pipes were to have been connected up with a piece of rubber hose; but this device to save time was, like other schemes of mice and men, frustrated by the manufacturers being totally incompetent to be up in their deliveries. I expect Belgium or Germany would have done better. However, an 18 in. by 9 in. taper pipe, with a shallow lead joint at one end, and a modification of the original plan made at home, did duty at the other or 14-inch end every night.

The longest days had to be made the best use of; and everything that would save time was pressed into service, especially as we could only open up comparatively short lengths of ground, so as not to inconvenience the traffic. Here I found the pipe extractor invented by Mr. J. W. Helps, of Croydon, of the greatest service. The bags having been inserted in the usual way, this instrument was set to work, and very expeditiously disjointed the pipes, with no waste in the spigot or squaring up spawled ends before the 14-inch pipes were relaid later on. In fact, time was saved all round; so that I cannot speak too highly of the service rendered by this simple arrangement. The lifting two 9-feet lengths of 14-inch pipes out of the trench was performed by a tripod, with a sprocket wheel Weston pulley block, which was also used in lowering the 18-inch pipe into position. This arrangement I have found very useful when laying larger mains in the district.

I commenced breaking ground on the 26th of June; and the whole work was completed, and a double connection to two mains made, by the 22nd of the next month. Our average rate per day was 32 yards—some days more, and some days less. Just as we were nearing completion, a sudden thunderstorm broke over the town, with a tropical deluge of rain, which rose in the trench somewhat alarmingly—indeed, we had a very narrow escape from a catastrophe, as some of the joints were open; but the storm was of short duration and this was averted. This is the third main I have seen laid in the same trench at intervals during the past 40 years, to meet the demands of a portion of the community we have to serve.

Discussion.

Mr. WILLEY inquired if the pipes referred to were turned and bored; and also the depth at which they were laid.

Mr. HUMPHRYS said that in these days of cooking and heating stoves, gas-engines, and other appliances for daylight consumption, this question of enlarging and relaying gas-mains acquired increased importance. At Salisbury, they had recently to take up about a mile length of 3-inch pipe, and replace it with a 6-inch one; and on that pipe they had several consumers who used gas for cooking and other purposes, with whose supply they did not wish to interfere. The means by which they effected this was by laying as many pipes as they could in a day—say, ten or twelve—and making up a temporary wrought-iron connection with a hole bored in one side of the pipe and another in the line laid parallel to it. They began first by inserting a T-piece at the end of the main; and, having got that in, they did not interfere with the supply again until they made the connection at the other end. They first broke the connection, and then proceeded to lay down twelve more 6-inch pipes; and at the end of the twelfth one, they drilled two holes and made up with a piece of 2-inch wrought-iron pipe. They had a corresponding length of 3-inch pipe left; and they broke that out, and stopped it off just at the other side of the 2-inch connection. Several of the street lamps were not alight at the time; but there were no complaints of shortness of supply from consumers.

Mr. J. LOWE (Weymouth) referred to two or three instances of new main-laying work which he had carried out; but he said he had not experienced any great difficulty or, by keeping both mains alive, occasioned any inconvenience to consumers. He had a little trouble some time back when laying an 18-inch flange pipe under water. The work had to be done at low tides; and when the water came in, it washed in a good deal of sand.

Mr. PADFIELD agreed that the plan of keeping the mains alive was no doubt the right one. He had had to put down a 15-inch pipe on one side of Exeter; and they done the work pretty expeditiously. Before laying a pipe of this kind, it was best, where there were sewers and electric light and other pipes, to open up a trench for some distance, so as to see where they were going. Wherever he possibly could, he laid the pipes

in the footpaths; and this resulted in a saving of labour, a lessening of leakages, and other advantages. The great aim he had was to reduce the amount of leakage. About 21 years ago, they had in Exeter something like 28 per cent. of leakage; and now it was a little more than 5 per cent. The plan they had adopted during the last ten or twelve years of laying the mains in the footpaths, pitching and placing the services in troughs, using the best material, and taking great pains, was the one to produce the best results in the end.

Mr. LOWE wished to add to his remarks that his experience was that the pitching of mains was a very "ticklish" operation to do successfully. If the pitch was a little too hot, and it blew, forming small air bubbles, it tended rather to the destruction of the pipe than to the extension of its life. If the pipe was wet, too, the pitch would not adhere; and it would be very rapidly destroyed. He had abandoned pitching altogether. Tar being a drug (they had only a small sale), they had adopted the plan of mixing it with breeze, and laying the pipes on a bed of that. They then drenched them with tar, and covered them up with tar and ashes. In laying an old pipe for temporary use some 40 years ago, he had adopted this expedient; and, to his astonishment, some ten years later, he found the pipe was still perfect.

Mr. DEXTER stated that he recently had occasion to lay close upon a mile of 8-inch main; and in its course he had to pass over two old bridges (dating back some 300 years), the stones of which were of very great depth. The old main passed over the crown of the bridge, with only a covering of 2 or 3 inches of soil—a condition of things which led to difficulties in the winter. In laying the new main, he had two complete courses of the stonework taken out of the crown; leaving the bridge in two sections. He then built across the bridge some 16-inch pipe to act as a sort of tube, through which the main was laid. It was heavily jointed with lead, and slung up to the stone arch by wrought-iron bands at frequent intervals. They then passed the main through, and packed it with sawdust, and securely closed up the ends. This had completely overcome the deposition of naphthalene through exposure. He also bore testimony to the extreme usefulness of Mr. Helps's pipe extractor, to which Mr. Durkin had alluded.

The PRESIDENT, referring to the covering of pipes, said he had adopted for some time now the practice of laying them in troughs, and covering with pitch. He was that day commencing to lay 2 miles of high-pressure oil-gas mains at Bristol; and they were using what was known as Perkins's pipe with the V end on to the flat end of the other pipe. The left and right hand thread socket drew the V-shaped edge into the flat end of the pipe; and they could in this way be joined up so as to stand a gas pressure of 200 lbs., without leakage. They were placing the pipes in troughs, the wood of which was dipped in carbolineum, and the whole was covered with liquid pitch. They had had some of these mains in use from five to seven years; and when they had been making alterations, they found they were still perfect.

Mr. DURKIN, in replying to the discussion, said that the pipes referred to in his paper were not turned and bored; they were open lead joints. With regard to the depth of the pipes, in his district the frost entered the ground quite a foot; and, if he were opening up a new road, he should lay his pipes 2 feet underground. In the case to which he referred in the paper, one part of the main was quite 4 feet deep. Some two or three years ago, they had to carry a line of pipes over two iron bridges. One was formerly a wooden structure; and the main (which was a 9-inch one) was laid on one side of it on cantilevers. Now this pipe was not covered up; and it might interest the members to know that, wherever the pipe was exposed, they never had any trouble by the deposition of naphthalene; but at the entrance and exit of the pipe, where it was laid in rather cold and damp ground, they had frequently to remove that substance. When the bridge was re-built, they carried a 14-inch pipe across it. There was a place provided for it on the structure itself. The pipe which they used was one that was largely employed in colliery districts. About 4 inches from the spigot end, there was a fillet cast on; and the bead end of the spigot was raised to receive an indiarubber ring. The spigot end being passed into the socket, it was forced in; and the rubber ring was flattened and rolled until the end of the spigot was bedded up to the back end of the socket, and the fillet prevented the ring coming out at the front. This had been in operation some three years; and there had never been any leakage or disturbance.

A vote of thanks to the President for the able way in which he had conducted the duties of his office during the past twelve months concluded the proceedings.

Death of Mr. C. W. Heaton.—We regret to record the death, on the 11th inst., at his residence at Bedford Park, of Mr. Charles William Heaton, Lecturer on Chemistry at Charing Cross Hospital. Mr. Heaton was best known to readers of the JOURNAL in his capacity of Chemist to the Ammonia Gas Purifying and Alkali Company, Limited, which was formed to work the Claus process of gas purification. He contributed an article on this process to our columns in July, 1887; and later that year he collaborated with Mr. C. W. Watts in another communication on the same subject. Deceased was in his 59th year.

EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.

The Tenth General Meeting of this Association was held at Melton Mowbray last Wednesday. The members commenced to assemble at the gas-works about noon; and there they met with a very cordial reception from the Directors of the Company. The works, which have been under the care of Mr. T. Greaves for the past 25 years, are a model of neatness; and every part of the plant bears testimony to the careful attention which is bestowed upon it. The annual output at present is about 24 million cubic feet; but the principal portion of the works has been laid out to produce up to 100 millions, with very little extension. Some 14 years ago, a new retort-house and gas-holder were erected. The former is a spacious building; and in it the visitors saw two huge stacks of coal, which will carry Mr. Greaves well into November—a position which must have been coveted by several of the gas managers present whose stocks are beginning to cause them some uneasiness. Having been conducted round the works by the Chairman of the Company (Mr. George Fitton) and Mr. Greaves, the members were photographed; and, before leaving, they had further evidence of the hospitality of the Directors in the shape of a luncheon. The members afterwards walked through the town to the Collis Memorial Hall, where the meeting was held.

At the commencement of the proceedings,

The HON. SECRETARY (Mr. H. Wimhurst, of Sleaford) read a letter which he had received from the President, Mr. W. Duesbury, of Cambridge, informing him that, through a serious illness, he would, much to his regret, be unable to attend the meeting.

On the motion of Mr. W. BARRATT (Grantham), seconded by Mr. GREAVES, Mr. C. E. Jones (of Chesterfield), was requested to preside.

Mr. JONES, having taken the chair, said he was sure Mr. Duesbury would accept from him, as the mouthpiece of the meeting, their heartfelt sympathy with him in his affliction, and their most fervent hopes for his speedy recovery.

A WELCOME TO THE TOWN.

Mr. FITTON said he wished to take that opportunity of assuring the members, on his own behalf and that of his co-Directors, that they had the greatest pleasure in welcoming the Association to Melton Mowbray. They had not much for the members to see; but they could show them a very neat and compact gas-works.

The CHAIRMAN, in reply, asked Mr. Fitton and his colleagues to accept the hearty thanks of the members for the kindness they had manifested to them that day. He must add that better organized and cleaner works devoted to the manufacture of gas he did not remember having seen.

NEW MEMBERS.

Mr. C. J. N. Row, of Long Melford, and Mr. G. Erant, of Braintree, were elected members.

Mr. J. G. HAWKINS (Spalding) then read the following paper on the

PURIFICATION OF COAL GAS.

Gas purification may justly be considered one of the most, if not the most, important branches connected with the gas industry. It is of the utmost importance that the gas as supplied to the consumers should be perfectly pure, lest the products resulting from combustion should be such as to vitiate the air, and render it injurious to health. The impurities present in crude gas may be enumerated thus: Carbonic acid, ammonia, sulphuretted hydrogen, and bisulphide of carbon. There are other impurities; but these need not be considered on the present occasion.

Carbonic acid has the effect of reducing the illuminating power; 1 per cent. of it reduces the amount of light 6 per cent. Ammonia exerts a corroding influence on brass and copper fittings. Sulphuretted hydrogen is perhaps the most obnoxious of all the impurities, chiefly because of its disagreeable odour in case of leakage and the rapidity with which it tarnishes bright metal, gilt mouldings, and silver plate. Bisulphide of carbon, when burning, produces sulphurous acid, which by exposure to the air rapidly changes to sulphuric acid, and which together with any moisture present is deposited on the furniture, books, mouldings, and paintings that may happen to be in the room where the gas is being consumed, having a very deleterious effect. How, then, these impurities may best be removed, is what we have to consider.

It may be taken that purification begins at the hydraulic main; but, for our purposes, we need go no further than the inlet of the condensers. The temperature of the gas at the inlet of the condensers is usually about 130° Fahr., according to the number of retorts at work and their situation. The temperature at the outlet of the condensers should be about 60° Fahr. By this cooling process, all tarry and aqueous vapours held in suspension are thrown down as liquid tar and water respectively. It is well known that water in a fine state of division rapidly absorbs ammonia and sulphuretted hydrogen, and that ammonia combines with carbonic acid. This being so, it follows that too sudden condensation should be carefully avoided, lest the aqueous vapour is thrown down before it has had sufficient time to become charged with these impurities.

It is desirable, therefore, that the condensers should in all cases be in proper proportion to the make of gas, and on such a principle as to render too sudden condensation impossible.

The next stage we come to is the scrubber. Why it is called a scrubber I do not know; as that name, to my mind, conveys a very erroneous impression of its real object. There should, however, never be less than two of these so-called scrubbers, no matter how small the works are—the gas entering first through one and then through the other. The first should be supplied with a continuous stream of ammoniacal liquor; and the second with a continuous and carefully regulated stream of clean water. The first scrubber will eliminate the bulk of the remaining ammonia, in combination with carbonic acid and sulphuretted hydrogen. The second scrubber, being supplied with clean water, will completely remove all remaining traces of ammonia, as well as a small quantity of carbonic acid and sulphuretted hydrogen.

We now come to the purifiers proper. The impurities that have to be eliminated at this stage are the remaining traces of carbonic acid, sulphuretted hydrogen, and bisulphide of carbon. In towns where the gas authorities are not compelled by Act of Parliament to remove sulphur compounds other than sulphuretted hydrogen, the elimination of the bisulphide of carbon is not of importance; and in those cases oxide of iron alone might be used. But where the authorities are compelled to keep the sulphur compounds within prescribed limits, the removal of the bisulphide of carbon is essential; and this necessitates the employment of lime. Some engineers prefer to use both lime and oxide—placing the lime first, with the object of removing the carbonic acid and the bisulphide of carbon; and the oxide last, for arresting any traces of sulphuretted hydrogen. Others, doubtless on account of economy, are content to use oxide of iron only; and in such cases, of course, sulphuretted hydrogen is the only impurity dealt with. I have found that the best way to use oxide of iron is in layers of 1 ft. 6 in. deep; two layers in each purifier. I have purified more than 100 million cubic feet of gas with one single change of purifier when using oxide of iron. The oxide was new when put into the purifier; and, when taken out, it contained 50 per cent. of free sulphur. These results were obtained with the atmospheric air process, introduced by myself some few years ago, and which I explained in a paper I read at a meeting of the Manchester District Institution of Gas Engineers. The process is continuous, and offers great advantages where oxide alone is employed.

At the Spalding Gas-Works, of which I am Manager, I have recently been making some experiments with regard to gas purification with lime. These experiments are as yet far from complete; and, as a consequence, I am unable at this meeting to give you all the information I should like respecting it. Our annual make of gas is 22 million cubic feet; and our purifying plant consists of four purifiers, 8 feet square by 3 feet deep. Previous to the commencement of my experiment, it was usual to change three purifiers every fortnight in the winter, and an average of two every three weeks during the summer. I commenced my experiment on the 10th of May (just four months ago), when I had the usual two foul purifiers and one clean one. I began by introducing a carefully regulated quantity of atmospheric air into the gas at the inlet of the condensers, amounting to 2 per cent. Two days later, I found that I had only one foul purifier and two clean ones; and for a week we remained stationary in that position. I then increased the atmospheric air to 2½ per cent., with the result that two days afterwards I had no foul purifiers whatever. We continued in this position for a whole week, carefully noting the quality of the gas the whole time. I then shut off the supply of air; and within a few hours the first purifier showed traces of sulphuretted hydrogen. In three days it had got decidedly foul; and the No. 2 purifier also showed traces. I then re-introduced the air as before, with exactly the same result, which I have repeated many times. At present, all our purifiers are clean—not one showing the slightest trace of sulphuretted hydrogen.

The quantity of gas made from the commencement of the experiment up to now is 4,208,000 cubic feet; and during this time there has been no change of purifier whatever, and the purifiers that were foul at the beginning are now clean. The illuminating power of our gas is about 17 candles, which has, if anything, been slightly improved during the experiment; and our make of gas per ton of coals carbonized will average close upon 11,000 cubic feet.

Thinking it would be of interest to the meeting if I abstracted a sample of the material from the first purifier, I have just had that purifier shut off, and a sample taken therefrom. On analysis, it will be found to contain 29 per cent. of free sulphur. It is perfectly inodorous; showing clearly, therefore, that it has a considerable commercial value, and must no longer be looked upon as waste, nor to become a nuisance. I have also brought with me a sample of sulphur obtained from 100 grains of the material taken from the sample now before you.

In working upon this system, great care must be taken to keep the percentage of air constant, and in regular proportion to the make of gas. As the make of gas varies, so must the quantity of air vary accordingly. This can only be accomplished by some suitable contrivance working in combination with the station meter. Such an arrangement is in operation at the Spalding Gas-Works, where it may be inspected by any members who choose to do so.

My experience of lime and oxide purification up to the present is decidedly in favour of the former; it being, in my opinion, the better purifying agent of the two, and more economical.

Discussion.

Mr. GREAVES said he noticed that Mr. Hawkins worked with layers of 1 ft. 6 in. thickness in his purifiers; but he found, from practical working during the past 14 years, that from 3 to 4 feet layers of oxide of iron were preferable. He had previously tried lighter ones; but they were not sufficient to properly perform the work required of them, and therefore he increased them in thickness according to the depth of the purifiers. With respect to the difference between lime and oxide of iron, his experience of the latter for something like 16 years was that it was quite equal, both in regard to economy and purification results, to the use of lime alone, by finishing off with lime in the last box. With reference to the admission of air, he had been working on this system for the past four years; but while the author of the paper only gave 2½ per cent. as the extent to which they should go, he had gone as high as 3½ per cent., without deteriorating the illuminating power of the gas. He never on any account supplied gas of less than 18-candle power (he was told that it was that day registering 20 candles); and in the winter months it went up to 22 candles. As Mr. Hawkins stated, it required a great deal of experience to pass in the proper proportion of air to the quantity of gas being made. He admitted the air at the same point as Mr. Hawkins—on the foul main, before the gas reached the condensers. The admission of air was a great improvement in the purification of gas. He had not changed his purifiers since May 6, and would not have to do so before the end of October.

Mr. F. WELLER (Southtown, Yarmouth), as manager of a small works, making about 14 million cubic feet of gas, said, when he heard papers read like the present one, it made him wish that he could change his purifiers a little less often. He only used lime, and had three purifiers, 8 feet square, and 3 feet deep, in each of which he had four layers. He should like to be informed how Mr. Hawkins regulated his air supply.

Mr. J. BARTON (Peterborough) said that the subject under consideration was a most important one. At his works he had had a patent process in operation for about twelve months. He did not like the idea of drawing in air by the exhauster in a random sort of way; so he had special plant put down for drawing in the air and carburetting it at the same time. He had found very great benefit from this system, without injurious effects on the illuminating power of the gas. Using very much the same kind of coal during the past twelve months as previously, he had not had the slightest difficulty in keeping the illuminating power up to 17 candles in the winter, and a little above in the summer. He did not go so far as Mr. Greaves, but adjusted the air to as near 2 per cent. as possible on the make of gas. It was most important that the percentage of air should be uniform. If too much was admitted, it did considerable harm; but the right quantity did a great deal of good. He worked with two boxes of oxide of iron, and one partly filled with oxide, with a top tier of lime; and sometimes he did not use lime at all. The difficulty which he experienced was not so much in keeping the purifiers clean, as the back pressure. He did not know how he should go on if he employed, as Mr. Greaves did, 3 or 4 feet of oxide. He never used more than 18 inches, and had had to reduce that to 16 inches, in order to get the purifiers to do the work he expected of them. He had to change his purifiers, not because they were dirty, but because they gave him back pressure. The last purifier changed had passed something like 21 million cubic feet of gas; and one of the present purifiers had passed more than 25 millions, but he found the back pressure was beginning to increase. He was afraid if he added to the thickness of the oxide, he would not be able to pass anything like the quantity of gas he was now doing. He had no difficulty in putting something like 55 per cent. of free sulphur in the oxide. As to the percentage of air, he quite agreed that it should be kept constant; and if some scheme could be devised to adjust and keep it at the right amount, he believed that gas purification would be pretty well complete as regarded bisulphide of carbon.

Mr. A. DRAGE (East Dereham) remarked that at his works he used oxide of iron first and a catch lime purifier afterwards. The oxide was in 18-inch layers; but he found that the inlet bottom tier got very hard, and this threw a tremendous back pressure on the exhauster. The oxide in this bottom tier became much harder when the amount of "pull" on the exhauster had drawn air into the purifier.

Mr. BARRATT said there was no question this was a very suggestive paper; but it was surrounded by a number of incidents that had not been brought out. It was essential that they should know, first, something as to the author's condensation; second, with regard to the scrubbing; and third, the state of the gas before it went into the purifiers. It would be patent to everyone that, if they had condensers and scrubbers that were not doing their work efficiently, the gas must be in a very different state when it entered the purifiers than it would be under other circumstances. In his own case, he only used lime; and it would have been better if Mr. Hawkins had worked out for them the difference between the cost of purification by oxide and by lime, for, after all, it was a matter of £ *s. d.* He (Mr. Barratt) could buy lime at a fair

price, and get a fair price for his spent lime. Perhaps Mr. Hawkins and Mr. Barton could not do this; and therefore it would be cheaper for them to use oxide. With regard to the statement that some engineers used lime first rather than oxide, he could scarcely understand this, because his reading and observation showed that oxide was generally used first and the lime last, in order to take out any carbonic acid there might be in the gas. However, he was of opinion that condensation and scrubbing had very much to do with the purification of gas, and a great deal more than some gas managers gave credit for; because, if the condensers and scrubbers were very efficient, of course the purifiers would have less to do. When he first went to Grantham, he had five condensers, composed of 8 or 10 inch pipes. These were all right in the winter, but in the summer he had more condensation than was wanted; and he had no means of checking or altering this. The condensers were connected by a pipe, at the top of which there was a plate. He took off the caps, and introduced a 2-inch pipe from the top to the bottom, and screwed it into the flanges, and made them secure. He found this very efficient; and it improved his condensation to such an extent as almost amazed him, and the purification came down nearly 40 per cent. With regard to the scrubbers, if they were efficient, much stronger liquor would be obtained than would otherwise be the case.

Mr. BARTON here mentioned that at Peterborough, the cost of purification during the year ending June 30 last was about 0·3d. per 1000 cubic feet of gas sold.

Mr. J. CARTER (Lincoln) questioned whether Mr. Hawkins really meant what might be said to be the fair interpretation of the statement he made with regard to the removal of sulphur compounds other than sulphuretted hydrogen in those places where no statutory restrictions were imposed—that the matter was not of importance. Taking a broader and more general view of the question, he thought it was an important one; and it was extremely necessary that all gas managers should get the proportion of sulphur compounds down to as low a point as possible. His experience had convinced him that the exclusive use of oxide, even with the provision for atmospheric air, was not a completely satisfactory method of purification. The figures Mr. Barton had given them were exceedingly suggestive; and it was a very advisable position to get into, if they could accomplish their purification at ½d. per 1000 cubic feet of gas sold. In his own case, he found that, to get the sulphur compounds down to an average of 14 or 15 grains per 100 cubic feet of gas, he could not do his purification under something near ¾d. per 1000 cubic feet of gas made. There were two reasons why he discontinued altogether the use of oxide. When spent oxide could be sold at from 4d. to 5d. per unit, certainly there was more inducement to use it than under the condition that had obtained lately, when, if they realized 2d. per unit for the spent material, they done very well; and they were also confronted with the chronic difficulty of accumulating a large quantity of foul material on the works. He believed lime was the safer and better material to use in the purifiers. He was indebted to Mr. Hawkins for having read this paper, for it had reminded them of the possibility of using lime, and rendering it inoffensive and inodorous by the admission of a small proportion of air.

Mr. HAWKINS, in reply, said he agreed with Mr. Greaves as to the importance of having plenty of purifying area; but he thought that, as a rule, 18-inch layers would be found quite sufficient. He would not like to say that, by increasing the thickness, the purifiers would run longer, because then they might have to contend against back pressure. As to the adjustment of the air supply, he had a very simple and accurate arrangement coupled up to the drum-spindle of the station meter. He had a wheel which worked into the first wheel of the station-meter drum-shaft, and to this he had a counter-shaft that coupled up a 30-light wet meter; so that, at whatever speed the station meter was working, the wet meter, being set to a certain proportion, must keep in constant proportion with it. If the station meter passed (say, for example) 100 cubic feet of gas in one hour, and he wanted to admit 3 per cent. of air, the wet meter would send in 3 feet, and, if 1000 feet of gas was passing, then 30 feet of air would be sent in. If he desired to admit 4 per cent. of air, then he simply had to increase the size of the driving-wheel. He ought perhaps to say that, with a great percentage of sulphur in the coal, they would need a little more air; but, having ascertained the quantity, it must be kept uniform. With reference to Mr. Drage's remarks, he suggested that he should place a layer of 2 or 3 inches of breeze on the bottom tier; and this would take out the moisture in the gas, which no doubt caused the clogging, and would allow the gas to pass through comfortably. As to the cost of lime compared with oxide of iron, he contended that the purifiers at Spalding cost him nothing, because, at the commencement of his experiments, he had two foul purifiers and one clean, and now they had not the former. Of course, he did not mean to say they would last for ever. He agreed with Mr. Barratt that it was important the condenser and scrubber should be quite equal to the requirements, as there was no doubt a great deal of the purification was done silently in those vessels. Some people did not agree with washing the gas with ammoniacal liquor to any serious extent; but he found great advantage from it.

Mr. GREAVES said he would like to add to his remarks that he had found the hardening of the oxide to which allusion had been made was due to having too much moisture in the material itself. Mr. Hawkins had stated that the cost of his purification was "nothing." He had gone even farther than that; for, as his books would show, they had made a profit on it. It would be found that 1 ton of new oxide would make 2½ tons by the time it was ready to send away. For the new oxide, he paid £1 12s. 6d. per ton; while for the 2½ tons of spent oxide he obtained £1 7s. per ton.

Mr. HAWKINS also added that spent lime, containing 29 per cent. of free sulphur, would be worth, at 4d. per unit, from 12s. to 14s. per ton.

The CHAIRMAN, in concluding the discussion, said there was no doubt whatever as to the propriety of having the condensing and scrubbing apparatus in proportion to the purifiers; but one point that appeared to him to be lost sight of was the velocity at which the gas travelled through the purifying material, which must of necessity be more or less dense. The lighter it was, the easier would the gas pass through; and the denser it was, the greater would be the back pressure. It also necessarily followed that, if they had a large area, the gas would pass through the material at a low velocity; and, with only one-half the area, it must always go as fast again. The broad question of area (which possibly was not raised in the paper so much as it might have been) was one which should receive more attention than it had done, as it was the long-continued contact of the impurities that they desired to eliminate with the purifying material which rendered efficient any system of purification. It was quite true that purification of the gas commenced at the hydraulic main, and ran right through until it reached the purifiers. He held that the purifiers should be simply the finishing vessels. They were learning more and more about this question of purification; but they were not yet thoroughly versed in all those wonderful changes which took place in the purifying apparatus. He hoped the time would come when they would know a great deal more about them. They were very grateful to Mr. Hawkins for his paper; and he proposed that a cordial vote of thanks be given to him.

Mr. WIMHURST seconded the motion; and, in doing so, mentioned that he was at Spalding a short time since, and saw Mr. Hawkins's apparatus there before he had it so complete as at present. He then found that the first purifier only showed a small trace of sulphuretted hydrogen; and the other two were perfectly clean. He was so convinced of the desirability of admitting air in the purification of gas with lime that he intended to increase the amount they had been passing, which was only about ½ to ¾ per cent.

The CHAIRMAN observed that his experience of air purification in combination with lime and oxide was that, if 1½ per cent. was exceeded, then they got beyond the dangerous limit. He was surprised to hear that some members used 2 per cent. and upwards; and, furthermore, he was astonished at the statement that it had no effect upon the illuminating power of the gas.

The motion was carried by acclamation.

Mr. W. H. MANWARING (Lincoln) next read a paper on

GAS-COOKERS.

In submitting a paper on this subject to your Association, I am well aware that it is unnecessary for me to advocate the general policy of inducing additional consumption of gas by this or any other means. Whether the increase is to be obtained in the direction of lighting, heating, or power, we are well agreed as to the desirability of selling more gas each year than we did in its predecessor; and it is a comfortable fact—predictions to the contrary notwithstanding—that this hope is in most cases realized. Gas as yet stands pre-eminent as the popular lighting agent; and it is advancing steadily into very respectable rivalry with steam as a source of power.

On the score of economy, we need not expect gas-fires to supplant coal, except where intermittent service is required. It is then admitted to be the best and cheapest fuel. But, when used for cooking, the unmistakeable superiority of gas is most apparent; and the progress which has been made in this direction, wherever there has been the opportunity—progress, in spite of apathy and prejudice—proves that for cooking purposes the gas-range has no equal. From the standpoint of the manufacturer of gas, this is extremely satisfactory. Gas-fires are a very useful adjunct to ordinary winter business; but cooking-stoves create a demand when the works would otherwise be comparatively idle. The encouragement of day and summer consumption tends towards a nearer approach to uniformity of demand; and this is perhaps as much to be desired by ourselves as by our electrical friends. It is to gas-cooking stoves that we must look, as the principal means for the attainment of this end; although there is room for much improvement in the development of gas for industrial and technical purposes.

In this direction will also be found the best remedy for a complaint from which small gas undertakings especially suffer—namely, excessive capital in proportion to the amount of their yearly business; and it is only by fostering summer consumption (which does not need additional capital outlay) that they can hope to neutralize the effect of this disadvantage, and to materially reduce the price of gas. This class of trade yields a profit which is so substantial as to make it almost the duty (certainly the best policy) of every manager of every gas-works,

large or small, to advocate its adoption. If no trouble is spared to give the new venture a good start—say, by some such means as an attractive exhibition, with lectures on gas cookery—the results will be at once apparent. Each efficient cooker will be its own best advertisement; and its influence will sometimes be traceable through a large circle of acquaintances. After a short interval, business may be stimulated by the publication of local testimony to the advantages of cooking by gas, which can be obtained readily enough. The letting-out of gas-stoves will be found to cause increased sale, directly and indirectly, inasmuch as the use of gas for this purpose generally has an effect in removing any prejudice which may exist against gas-fires and other gas apparatus. The business is permanent and certain; and it does not fluctuate. Under ordinary circumstances, those who have used gas-ranges which are properly fixed will not be without them if they can help it. It is essential, however, that the cooker be "properly fixed," if it is to give satisfaction. If this is not done, it will be an unmitigated nuisance, not only to the person using it, but to everyone in the house.

The profit which is derivable from this source can be conveniently divided into that which is made in the winter and that in summer. It is a well-established fact that, in many cases, a large amount of gas is used for cooking throughout the year. Stoves are frequently fixed because the ordinary kitchen range cannot be made to work properly; and the undoubted superiority of the results achieved in a gas-oven causes it to be used during the whole of the year by no inconsiderable section of the community. It is, however, difficult to estimate, with any approach to certainty, the amount of gas so consumed in the winter quarters, unless a special meter is affixed to the cooker—particularly now that gas-fires are becoming more common. I have, therefore, confined myself to the increased consumption during the two summer quarters only; and this the more readily, as it is to the profit on this extra summer consumption that I particularly wish to refer.

I have tabulated a large number of our customers, who are using the two sizes of cooker most in vogue in Lincoln. These are a small unjacketed cast-iron stove which costs us £1 8s.; and one which we buy for an average of £3 6s. 8d., which is enamelled and jacketed with a non-conductor. In each case, the consumption has been taken during the summer preceding the fixing of the range, and compared with that for the corresponding period after its use has commenced. The average increase due to these two stoves amounts to 7500 cubic feet for the smaller, and 9200 cubic feet for the larger. Note that this is not the annual increase, but only that caused during the two summer quarters. As a rule, a bigger stove shows a relatively higher consumption, and costs proportionately more to fix; but these sizes will serve to indicate what may be expected from an ordinary household.

The average inclusive cost of fixing the stoves is 7s. 5d. and 9s. 8d. respectively, which covers the provision of a compo. feed-pipe, union, galvanized flue-pipe, carriage, and labour. Once fixed, the further expenditure for keeping the cooker in a proper condition is very slight. The few breakages which occur, are made good at a comparatively small expense; and the same remark will apply to the renewal of parts and fittings which are burnt or worn out.

With regard to the return which is yielded, I think we may adopt a different basis to that which would be used if the extra consumption were induced in the winter. Any increase is then chargeable (before the profit due to such increase can be estimated) with the interest on the capital necessarily expended in order that the demand may be met. But this additional summer consumption does not involve any expenditure of capital beyond the cost of the stove; and the only manufacturing items which can legitimately be said to be increased thereby are coals and purifying and labour for carbonizing. In many smaller works, there would be nothing added to this latter item. There is also an extra charge for maintainance of the cookers; but this amounts to no more than a fraction of a penny per 1000 cubic feet, and is sometimes taken into account, and returned as rental. All other expenses of manufacture would still be incurred to practically the same extent, whether the additional gas were made or not. The items I have named amount, in a case with which I am familiar, to just under 10d. per 1000 cubic feet; and the difference between this figure and what is received from the consumer is really the profit on the extra sale. Assume the selling price to be 2s. 6d. per 1000 cubic feet, then the small stove will add 18s. 9d. to the receipts during the summer; and the larger one, £1 2s. 6d.—two-thirds of which (12s. 6d. and 15s. respectively) is profit. It is in consequence of this exceptionally large return, that the business of hiring-out gas-stoves is especially useful to smaller undertakings, which are as a rule heavily handicapped by the comparatively large amount which has to be added to the cost of gas in the holder for interest on capital; and in proportion as this amount is abnormally large, so will the benefit derived from increased summer consumption be enhanced.

There is generally a further profit to be gained by means of the rental charged for the use of the cooker. In this respect, there is a considerable difference of opinion. Some hold that the rent should cover, not only the interest on the first cost of the stove, but also on the amount expended in fixing and maintaining it, as well as providing for its depreciation in value and ultimate renewal. On the other hand, there is the policy of keeping the rentals at the lowest possible figure—remaining satisfied with the profit arising out of the gas consumed. Bearing in mind how easy it is to hamper a new line of business, the latter course seems the preferable one. For the two types of cooker I have instanced, perhaps the happy medium may be found at 6d. to 1s. per quarter, which should not be much exceeded. At this figure, similar ranges can be hired in several towns, though a considerably higher rate is charged in others.

For many reasons, I believe the most satisfactory arrangement in the interests of both parties is that of hire-purchase, when computed on a moderate basis. Under this system, the consumer acquires a personal interest in his stove, which conduces to more careful usage and greater satisfaction. The gas manager is relieved of the danger of an accumulated stock of stoves of an older pattern, which may be thrown on his hands in consequence of a fancy for something newer in design, and possibly more taking in appearance, but which does its work no better than the stove it displaces. Further, when once the period of purchase has expired, there will no longer be the liability to keep the ranges in free repair. Simple hire will, however, always be preferred by a certain class of consumers; and arrangements will be necessary to enable the majority (or that portion which is new to the use of gas as a cooking agent) to obtain the stove on simple hire for a trial period, before committing themselves to purchase.

Opinions differ as to the necessity of providing a stamped agreement for signature by the would-be hirer. This generally stipulates for a minimum of one year's tenancy, and a guarantee to make good any wilful damage to the stove. It is often difficult to say what is wilful damage, and what fair wear and tear; and as regards the other clause, the use of a gas-cooker is such a decided boon to the great majority of consumers, that the stove is retained unless a very good and sufficient reason prompts its removal. This provision of an agreement is a step which seems natural and prudent, as safe-guarding the interests of the purveyor. But, speaking from experience, the cases where it is worth its stamp are few and far between; and the necessity for signing a legal document will sometimes act as a deterring influence with an undecided would-be customer.

Where gas is supplied by a private company, of course, there is no restriction as to the extent to which the sale or hire of gas apparatus may be carried. But when the undertaking is in the hands of the local authority, a certain amount of trade jealousy will mostly have to be contended with. The demand for cooking-stoves is very limited until they are brought within the reach of all by easy terms; and sometimes arrangements can be made for the fixing to be done by local gas-fitters, under supervision. In this case, their gain will probably more than counterbalance their loss. There can, however, be no doubt that gas undertakings should always be considered as purely business concerns, and worked on business lines.

As to the average life of a gas-cooker, and the allowance which will cover depreciation. In this connection, we have not (after seven years) any stoves which can be said to be worn out; most of them being, for all practical purposes, as good as new. This appears to be a very satisfactory proof of their indestructibility, especially when the trifling initial cost of the smallest is borne in mind. I should think a considerable proportion will be in good condition after, say, fifteen years' constant service; and as by that time each cooker will have paid for itself, perhaps two or three times over, it may be consigned to the scrap-heap when worn out, without much compunction.

When fixing a gas-stove, it will not be found that, in the ordinary run of cases, any enlargement will be required either of the service or the meter. The supply for the cooker will nearly always, however, have to be taken directly from the meter outlet. Sometimes it may be possible to obtain an efficient supply for the smallest size from some internal fitting nearer than the meter; but this is seldom or never practicable with any larger stove. In the distant future, we may hope to find a pipe of sufficient capacity laid to a convenient recess for the cooker in every decent cottage; but I need hardly say that this is at present very much the exception, not only with the cottage, but with any other class of house. Too much importance cannot be attached to the maker's injunction to allow an ample supply; and economy in this particular is much to be deprecated. Unless the connection is of unusual length, the main-pipe of the range will be the best guide as to size; but care should be exercised that the bore is not crippled by careless workmanship. As soon as any considerable number of cookers are in use, it may be found advisable to allow 3-10ths or 4-10ths additional pressure during that part of the day when they are most wanted. This was necessary in our own case.

Assuming that the stove is in a perfect condition, and has an abundant supply of gas, the most probable ground of complaint will be the stench-pipe from the oven. Much trouble has sometimes to be taken before this part of the equipment can be made to work satisfactorily. The best material of which to make these pipes is galvanized sheet iron; and they should be taken into the nearest flue or chimney with as little deviation as possible. If no chimney is available, perhaps the best alternative is to carry the pipe into the false-roof. Only in the last extremity should it be led through an outside wall, and where this cannot be avoided it should be continued until it is about a foot higher than the top of the wall; but stench-pipes of this

description are nearly always liable to a reversal of the current. Matters are sometimes improved by covering such a flue with non-conducting composition, or by enclosing it in a wooden casing. This prevents the cooling of the products of combustion, and their consequent return into the oven. No pains should be spared to render this part of the apparatus effective. A cooker which is always liable to the extinction of the oven-burners is a source of much danger; and, apart from this, nothing is more objectionable than to find the house filling with noxious fumes.

The other complaints to which attention will be necessary are mostly due to the presence of grease or dirt in the burners; and special attention should be directed to the printed instructions for keeping them clean. The usual effect is that the burners refuse to light properly; and in this respect Mr. Fletcher's caution—that no tampering should be allowed with the adjustment of the proportions of gas and air—ought to be enforced. If the cooker has once performed satisfactorily, the fault can nearly always be found, and removed, without this being interfered with.

The most expensive item connected with the maintenance of gas-cookers is that of cleaning, and, when necessary, repairing those which have been returned from hire. The condition in which some of these are received is anything but creditable to those who have used them. After all the dirt and burnt grease have been removed, a coat of Berlin black, and the provision of new tins and fittings (if required), should enable the range to be re-let nearly as readily as a new one. The cost of this course of treatment will average perhaps 5s. per stove. But much can be done in this direction when other business is not pressing; and it will then cost practically very little.

Before concluding, I should like to draw especial attention to the importance of pushing the hiring-out of cookers amongst what are generally known as the working classes. Few towns have such a relatively large artizan business as Lincoln; and experience shows that, as a class, they are exceptionally worthy of cultivation. The use of cooking-ranges is certainly not encouraged amongst them to the extent it deserves. The sizes I have named (and especially the smaller one) lend themselves admirably to this business; and, if fixed free of cost, with a low rental, it should not be a difficult task to convince working-men of the many advantages to be gained by their adoption. They occupy very little room; and more particularly in small houses with such a summer as the one we have just experienced, they will make all the difference between a comfortable home and the reverse.

In this connection, prepayment meters should be of use, as affording a ready means of proving that gas can be used for cooking at least as cheaply as coal, which proof is invariably necessary. In homes of this description, the stove is under the personal supervision of the mistress; and the trouble which is experienced in other circles, with the servant girl, does not here exist.

From our point of view, this field will be found to repay cultivation to an equal, if not a greater, extent than where larger stoves are required; and in most towns the field is extensive enough. As sellers of gas, we are becoming more and more alive to the fact that, with regard to its use for lighting, there is ample room for extension among houses of the smaller class; and the same may be said with equal force with reference to its application for cooking purposes.

There is no valid reason why the possession of a gas-cooker should not be with all classes the rule, and its absence the exception. Once used in this manner, gas speedily becomes practically indispensable; and it is promoted from its position as a convenience, into that of a necessity in every well-regulated household.

Discussion.

Mr. W. J. Best (St. Ives) remarked that, if they ran a pipe from a gas stove or engine into the open air, as mentioned by the reader of the paper, he was afraid it would result in some trouble.

Mr. C. Grimwood (Sudbury) said some of the members might think he was a little conservative; but he must say that he preferred selling gas-cookers to letting them out on hire. At Sudbury, he had now 60 cookers in use, with an annual consumption of about 12 million cubic feet; and the majority of them had been sold. He made a rule, if he did hire them out, of charging 10 per cent. on their cost. It saved a good deal of trouble if the service-pipe for the stove was taken direct from the main; and he would go farther than that. He would have the old coal or coke stove taken out, and make a thoroughly good and neat job of it. With regard to the cookers referred to by the author as costing £1 8s., he had not seen anything at that price which he should like to buy; and in small towns where they had to charge a high price for gas, they must have cookers which would do good work. His charge for gas for cooking was 4s. per 1000 cubic feet; and he found the average consumption for this purpose came to about £1 per quarter. In his case the consumers were bound to use the cookers all the year round, because he removed the coal ranges.

Mr. Hawkins said he had recommended his Committee not to hire out stoves, but to sell them at cost price, and fit them free of charge. At the exhibition they held at Spalding two months ago, there were rather more than 30 stoves sold; and they were still receiving orders. He never took the supply for cooking-stoves from the existing fittings, unless they were very large; and in some instances they had fitted meters to the stoves. In one case they fixed a stove on April 19, and took the meter registration on July 19—that was 92 days—and the cost for cooking (it was a large house) averaged 3¾d. per day. Throughout that time, coal was dispensed with; and the consumer reckoned he had saved a little over 10s. by using gas instead of coal.

Mr. Wimhurst remarked that, if they could not get the consumers to buy stoves, they must let them on hire. At Sleaford they started in the stove business thirteen years ago; and a fair trade had been done ever since. At the present time, they had only one small cooker on hand. Whenever a stove was returned for cleaning, he charged the cost of doing this to the consumer; and in only one case had there been a refusal to pay. They had also lately been introducing the penny-in-the-slot meter; and in all cases they had put in a boiling-ring as well, and in some cases a small cooker—charging for this 9d. per quarter extra. Since the 1st of June, 60 of these meters had been fixed.

Mr. Drage stated that some seven years ago, they had an exhibition at East Dereham, and 30 stoves were let out on hire; but nine or ten of them had since been returned. Consumers seemed to let the stoves get into a very bad state; and then it took a man two or three days to properly clean them. They charged 3s. per 1000 cubic feet for gas used for cooking, and 4s. 6d. for that consumed for lighting; and the former price he found did not pay them by a long way.

Mr. Barton also stated that he let out gas-cookers at Peterborough; but he was not at all sanguine about them being called a success. He should prefer selling the stoves on the deferred payment system to letting them out on hire.

Mr. Manwaring, in reply, said with regard to Mr. Best's remark as to the stench-pipe being carried into the open air, he had said that it was the worst plan that could be adopted; but there were some cases in which it could not be avoided. There was no doubt that selling the stoves outright was to be preferred; but he thought the hire-purchase system was the best way of getting rid of the cookers. But at Lincoln the ironmongers had stepped in; and local influence had made it rather a difficult matter to get the Gas Committee to see the matter in that light. Running a service-pipe direct from the main for cooking-stoves would result in too many holes being made in the main; but it was quite as good, and saved expense, to carry a separate service from the meter. As to Mr. Grimwood's remark that the small stove was not worth his attention, in their case it paid better than any other; and the working men preferred it nine times out of ten. Since writing his paper, he had come across some figures published by Mr. Chester, of Nottingham, in which he placed the average life of a gas-cooker at eighteen years.

The Chairman said he was surprised that there was not more cooking done by gas in this country. He had been told that cooking in this way was not healthy; but he was a living monument of a man who had lived for over 40 years on food cooked by gas (laughter). For a cooker to be a success, it was desirable to have an ample service; and he rather inclined to the idea of a separate supply, because it was then possible to ascertain most accurately what was the cost as compared with cooking by ordinary coal fires. There was one thing which gas-stove makers should turn their attention to, and that was the production of a burner that would not fire back. The gas was imperfectly consumed; and the poisonous chemical compound acetylene was formed, which, when diluted with air, had a most objectionable smell. He also expressed himself as strongly opposed to the hiring out of stoves.

A hearty vote of thanks was passed to Mr. Manwaring for his paper.

Election of Officers.

On the proposition of Mr. Barton, seconded by Mr. Weller, Mr. W. J. Carpenter was elected President for the ensuing year; and, on the motion of Mr. Greaves, seconded by Mr. Hawkins, Mr. Grimwood was selected for the vice-presidency. Mr. Wimhurst was re-appointed Secretary and Treasurer; Mr. W. J. Wells (Stamford) and Mr. Hawkins were elected members of the Committee; and Messrs. Weller and Ellis were appointed Auditors.

The Spring Meeting.

The Chairman proposed, Mr. J. H. Troughton (Newmarket) seconded, and it was agreed, that the spring meeting should be held at Bury St. Edmunds—a letter having been received from Mr. Mitchell saying he would be pleased to give the members a hearty welcome, if they thought fit to visit the town.

Alteration of Rule.

After a brief discussion, it was agreed that Rule 10 should be altered to read: "That the meetings of the Association shall be held on the third Wednesday of April and September," &c.—it being generally admitted that March was too early for the spring gathering.

The Federation Question.

The Hon. Secretary read a letter which he had received from the Secretary of the South-West Association (Mr. Norton H. Humphrys) in regard to the subject of the federation of

Gas Managers' Associations, and enclosing the two resolutions passed at the meeting of that Association in April last.* The Committee (Mr. Wimhurst added) had decided to leave the matter in the hands of the members.

The CHAIRMAN remarked that, in his opinion, one of the chief points in connection with local institutions was that they were distinct and separate one from another; and, in consequence, they were more useful.

Mr. CARTER inquired if the Committee had not more information on the subject than was disclosed in the resolutions which had been read. The question would present itself to the minds of every one of the members, What useful purpose would be served by federation?

The CHAIRMAN thought that the advantages would be problematical; and, with the information before him, he should not be prepared to support the proposal.

The HON. SECRETARY remarked that he understood the Midland and the North of Ireland Associations had each appointed two representatives to attend a conference on the subject to be held in London on the 23rd inst.†

Mr. BARRATT also said he should like to have more information as to the benefits that would result from federation before they entered upon it. He thought the Committee ought to have inquired further into the matter, so as to have had something definite to place before the members.

Mr. HAWKINS was of opinion that two members ought to be appointed to attend the conference; and he proposed that Messrs. Carpenter and Grimwood be their representatives.

The motion having been seconded, it was put to the meeting, and six votes were recorded in its favour and eight against—several members abstaining from declaring either way.

VOTES OF THANKS.

Resolutions were next passed, thanking the President and officers for their services during the past year, and acknowledging the kindness of the Trustees of the Collis Memorial Hall for allowing the Association to meet in it, and also that of the Gas Company for their entertainment earlier in the day.

In the evening the members and a number of friends dined at the George Hotel, and subsequently the usual toasts were duly honoured.

Electric Lighting at Whitehaven.—The formal ceremony of turning on the current at the new electric lighting works at Whitehaven was performed on the 2nd inst.; and we are told by a local paper that the event was signalled by the discharge of a rocket! The Chairman of the Town Trustees (Mr. J. G. Dees) informed the assembled company that Whitehaven was one of the first towns to adopt gas lighting, and now it was among the first to adopt the electric light. On the advice of their Engineer, the streets were being lighted by incandescent lamps, as, owing to their narrowness, the light from an arc lamp would be wasted. He added that he thought the town would be lighted as well as it had been by gas for considerably less—certainly not more—than it had cost hitherto.

Dover Gas Company.—At the half-yearly general meeting of this Company on the 4th inst., the Chairman (Mr. W. Mannering), in moving the adoption of the report, which was noticed in the JOURNAL for the 29th ult., congratulated the shareholders that, notwithstanding the exceptionally brilliant weather which had prevailed since the early part of the year, the receipts from the sale of gas were within 18s. 4d. of the corresponding half of 1892; and there had been an increase of £34 4s. 4d. in meter and stove rentals. The accounts showed additional receipts to the amount of £134 for residuals. With reference to the expenditure, coals had cost less by 11½d. per ton; and the saving was £388 18s. 8d. Repairs and maintenance of works, including labour, cost £160 13s. more; and the other smaller items were a trifle higher. The results of the half-year's working showed an increase of £169 in receipts, and a decrease of £125 in expenditure, or an increased profit of £294. The profit balance of £3377 would pay the usual dividend (7½ per cent. per annum), and leave a sum of £677 to be carried forward. With this balance, combined with the more favourable terms on which their coal contracts were renewed for another year, the Directors felt they could safely reduce the selling price of gas to 2s. 9d. per 1000 cubic feet as from the 1st of July. This reduction meant rather more thna 8¼ per cent. off the quarterly gas bills; or, in other words, it would be a saving of about £2000 a year to the consumers. The usual satisfactory results had been obtained in the manufacturing department. During the half year, 7793 tons of coals were carbonized, and produced 87,086,000 cubic feet of gas, or equal to 11,174 cubic feet per ton. The quantity of gas sold and accounted for was 81,270,000 cubic feet, or equal to 10,397 cubic feet per ton of coal. All the necessary repairs and renewals had been made; and the whole of the works were in a thorough state of efficiency. He would only observe that the satisfactory results the Directors had had the pleasure of placing before the shareholders that day were largely owing to the united exertions of the officers and the men, who were all deserving of their cordial thanks for their continued efficient services. The motion was carried. The retiring Directors and Auditor were then re-elected; and the proceedings closed with the usual complimentary vote to the Chairman and Directors. It may be mentioned that the coal now carbonized at the works is of the same quality and proportions as it has been during the last seven years. About three years ago, the Manager (Mr. R. Herring) began to employ oil in place of cannel; and the results were so satisfactory that it is now solely used for enriching the gas.

* See JOURNAL, Vol. LXI., p. 683.

† See note to the second column of p. 531 of to-day's JOURNAL.

REGISTER OF PATENTS.

Stirring Oxide of Iron, Lime, &c., in Gas-Works.—Marshall, F. D., of Copenhagen, and Blum, E., of Berlin. No. 12,798; July 12, 1892.

The object of this invention is to obviate the necessity for hand-labour in gas-works in revivifying and turning oxide of iron, turning lime during the process of slacking, or for turning granulated or pulverized material, as applied to other industries.

The machinery required consists of two standards, with toothed gearing, fixed at either end of a platform. Round the gearing an endless chain passes, conveying motion to a travelling carriage, which is thus made to traverse the platform on a line of rails from end to end. The carriage consists of a hollow shaft carrying revolving shovels, and an internal shaft; and to the ends of the shaft are attached the necessary revolving and travelling arrangements, and the reversing arrangements. The machinery is set in motion by any suitable engine or motor, having attachment to one of the standards.

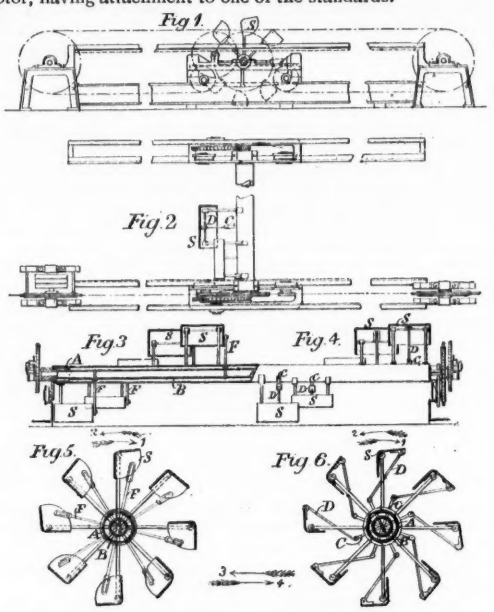


Fig. 1 shows a side view, fig. 2 a plan view, fig. 3 a portion (to the left hand) in section, and fig. 4 a portion (to the right hand) externally of an end view—all of an arrangement of mechanism according to this invention. Fig. 5 is a side view, partly in section, of a set of shovels and their gear separately. Fig. 6 is a similar view to the last of a modification of parts.

On the material to be turned or mixed being spread upon the platform, and the machine set in motion, the centre shaft moves in the direction of the arrow No. 4; the shovels revolving at the same time. By this means, the whole mass of material spread on the platform is thoroughly mixed and turned. On reaching the end of the platform, the revolution of the shovels is reversed; and the travelling shaft is caused to move in a contrary direction. On reaching the farther end of the platform, the reversing gear is again automatically set in motion; and the revolving shovels are made to move forward again—their action at the same time being reversed. This reversing action is brought about as follows: Inside the hollow shaft A, carrying the working shovels, there is another shaft B. On this shaft the parts C and D (figs. 4 and 6), and F (figs. 3 and 5) are fixed, so that C F pass through a corresponding slot in the shaft A, and are attached to the reversible shovels S. The motive power—the endless chain and ratchet arrangement—grips the inner shaft B, and is, by means of the parts C F, transferred to the tube A and to the shovels. These remain in position as long as the motion of the carriage continues in the direction of the arrow No. 1. When, however, the motion is reversed, the hollow shaft A and the internal shaft B are brought to a standstill; the reversing gear is set in motion; and the shovels are so reversed as to work in the direction of the arrow No. 2. This action brings the opposite side of the slot in shaft A in connection with the parts C F on the tube-shaft B; and thus causes the shovels to move in the desired direction.

Operating Gas-Hammers, Gas-Pumps, and Gas-Actuated Machinery Generally.—Clerk, Dugald, of Sutton Coldfield. No. 13,117; July 18, 1892.

This invention relates to a method of operating gas-hammers and the like, and mechanical devices for carrying out the improvement in its application to gas-hammers, gas-pumps, gas punching and cutting machines, gas-riveting and like machines. The invention is also applicable to gas-engines. The object is "to obtain the practical advantages of an explosion of compressed gaseous mixture in direct-acting cylinders or in gas-engines, while avoiding the use of compressing-pumps."

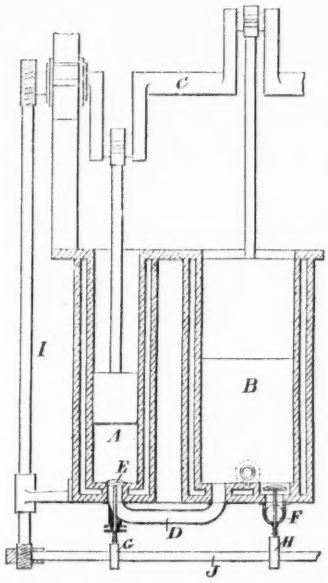
Part of the invention consists in a method of compressing a mixture of gas or inflammable vapour and air from atmospheric or other low pressure to a higher pressure, without the aid of a pump, by means of the ignition or explosion of a part of the combustible mixture (as described in patent No. 18,788 of 1891), and applying the compressed mixture to a hammer, pump, or engine cylinder, to be ignited to actuate it. The first part of the mixture which is ignited expands, and compresses the mixture which remains unignited into a chamber, through a check-valve, into a combustion chamber, where it is ignited; or from a first chamber into a second chamber through a check-valve, and from the second chamber through a check-valve to a third

chamber, which may be the combustion chamber. When multiple chambers are so used, the ignition spreads from one chamber to the next in series, or the chambers are ignited in series, so that a stage compression is caused, and a higher compression pressure is attained in the motor combustion chamber than would otherwise be the case.

Gas-Engines.—Piers, E. F., of Cheapside, E.C. No. 15,247; Aug. 24, 1892.

This invention has for its object the utilization of the force left in the products after the explosion in a high-pressure gas-engine cylinder, when the products have done their work on the piston of that cylinder in driving the piston forward.

To attain this object, a second (low-pressure) cylinder is employed, of greater capacity than the high-pressure cylinder. The piston of the low-pressure cylinder is connected to a crank on the gas-engine shaft, which is at an angle of 180° or thereabouts from the crank of the high-pressure cylinder; so that, when the piston of the high-pressure cylinder is making its forward movement, the piston of the low-pressure cylinder is making a return movement, and is compressing the air which it had drawn in during its last forward movement.



A is the high-pressure cylinder, in which the explosion takes place. B is the low-pressure cylinder. C is the crank-shaft, having two cranks, to which the piston-rods of the cylinders A and B are respectively connected. D is a passage giving communication between the cylinders; and E is a valve controlling the passage. F is the exhaust-passage, with a valve from the cylinder B, and an inlet for air thereto. The inlet-passages for gas and air to the cylinder A may be arranged as in ordinary gas-engines. During the outward movement of the piston of the cylinder A (consequent upon the ignition of the explosive charge therein), the inward movement of the piston of the cylinder B compresses a charge of air therein. As soon as the pressure in the cylinder B exceeds that in the cylinder A, the compressed air opens the valve E, passes into the cylinder A, and becomes heated thereby; and on the return movement of the piston of the cylinder A (the valve E being kept open at this time by the cam G), the air passes into the cylinder B, and exerts force upon the piston of that cylinder. The piston of the cylinder A, by its next outward stroke, draws in an explosive charge of air and gas, by the inlets therefor; and the piston of the cylinder B expels the contents by the exhaust F, which is then opened by the cam H. During the next inward movement of the piston of the cylinder A, the explosive charge is compressed; and the piston of the cylinder B draws in air at its inlet, which is compressed and passes into the cylinder A after the next explosion, and so on while the engine is operating. The valves E and F are operated by cams (so as to be opened at the requisite times) from the crank-shaft, by the gearing on the shaft I operating the cam-shaft J.

Heating Inclined Gas-Retorts.—Terrace, David, of Middlesbrough. No. 18,581; Oct. 17, 1892.

The claims for this invention are as follows: (1) Constructing gas-producers with ports or openings at a high level, through which the gases pass into the combustion chamber or into the retort-setting direct, there meeting the heated air (secondary) and producing combustion; the heat travelling from the top of the bed to the bottom gradually. (2) The combination or general arrangement of the producers, flues, ports, openings, and dampers for carrying the invention into effect. (3) Double producers for each oven or bed of retorts; one receiving new fuel while the other is in an incandescent state. (4) The heat from the producers being conducted downwards the full length of the retorts, impinging against the same, and so more effectively heating them on its way to the flues entering the regenerator.

The principal drawings accompanying the specification have already appeared in connection with the paper which Mr. Terrace read at the last meeting of The Gas Institute—see JOURNAL for July 4 (p. 18).

Referring to the subject-matter of this invention, the patentee says: Hitherto the gas-producers and regenerator chambers have been arranged in such a manner that the gases from the producer travel from a lower to a higher level, or on the same level, after combustion takes place; the products descending through the waste-heat flues, in conjunction with the passages containing heated air to support combustion. In this invention, a vertical gas-producer is placed at the higher level of the inclined retorts, immediately outside or inside. The heating gas from the ports from the producer, emerging underneath the retorts, meets the heated air, and combines with it; combustion taking place, and filling the inclined chamber or bed in which the retorts are placed, and travelling downwards. The retorts are supported on chequered walls on stepped covering (on top of the flues and air-passages), in such a way as to admit of properly heating the retorts without having recourse to tortuous passages or deflected currents. The inclined main arches of the beds are constructed of small stepped-courses, so as to secure level springings and general stability. Ports and surface openings are constructed above the producers, to facilitate the first heating of the beds. The openings conducting the products of combustion are at the lower end of the incline, and lead to the chimney through suitable flues. Between them are placed the heated air-passages, the air from which is conducted to the higher point to meet the producer gas, as before described. The flues containing waste products are preferably taken to a large underground flue, and thence to the chimney. Swivel dampers or other suitable means are employed to control the waste gas from the regenerators to the main flue. Hinged flap-valves are employed, to regulate the supply of secondary air for combustion. The steam or moisture under the producers is contained in a tube or tubes, and emerges through round holes or long slit-openings. The producers are made "double," so that one of them is in an incandescent state while the other is being cleaned and otherwise got ready for full production of gas.

Gas-Burners.—Williams, W. B., and Dean, W., of Bedford, near Leigh, Lancs. No. 7831; April 18, 1893.

The patentees declare the nature of their "invention" to be: "A gas-burner (of brass, or any other metal, composition, or porcelain) made to fit on any regulator gas-burner, or gas-pipe underneath any regulator gas-burner, and made in the form of a small balloon, with a row of small holes drilled across the top, or any other shape or form of burner made, so that the gas has room to expand after leaving the regulator burner." They claim that, by using any such form of burner, the illuminating power of the gas is considerably increased.

Manufacture of Water Gas.—Lake, H. H.; communicated from A. C. Humphreys, of Philadelphia, U.S.A. No. 13,482; July 11, 1893.

In view of the eminent position occupied by this inventor, and his close connection with water gas manufacture as practised in America, we give some copious extracts from the specification lodged with the application for the present patent.

The inventor starts by pointing out that his improvements relating to water-gas manufacture are founded upon the now well-known "Lowe" methods and apparatus; and they have been devised with special reference to enabling the practical and successful use of soft or bituminous coals, and the heavy oils (of which "Lima" oil is a well-known type), as distinguished from the use of anthracite coal and the light oils and naphthas heretofore ordinarily employed. These ends are attained by economically developing high temperatures—reducing what may be termed waste heat to a minimum—and by so working the oils that solid matters (residuary therefrom) are reduced to a minimum. He also greatly lessens their liability to impair the incandescing capacity of those heat-affording surfaces with which steam is brought into superheating contact; thus enabling "heating up" to be promptly accomplished, and a highly favourable degree of steam superheating, carburetting, and "fixing" duty to be performed at each run of the apparatus. By avoiding contact of the oil with the surfaces of interior portions of the apparatus, these latter are also more readily raised and maintained at favourable temperatures for performing the "fixing" duty during the passage of water gas enriched by gaseous oil. He has also, for the first time, he believes, provided for heating the carburettor by diverting a portion of the products of combustion from the superheaters and gas-fixing chambers, leaving the main portion of the products to pass to these last-named chambers, wherein much higher temperatures should be used than are required in the carburettor.

For economizing heat, the heavy oils, before their injection to the carburettor, are heated to as high a temperature as is proper or desirable, by an exchange of heat from the out-going gas, after it leaves the fixer; thus at the same time materially reducing the cost of cooling the gas in scrubbing and condensing. For obtaining within the carburettor, and also within the steam superheating chamber, a desirable combustion of gaseous matter while "heating up," the patentee proposes to employ a blast of air which is highly heated by such products of combustion as are discharged from either the carburettor or the superheater, or both of them; and he thus economizes what would otherwise be wasted heat.

Fig. 1.

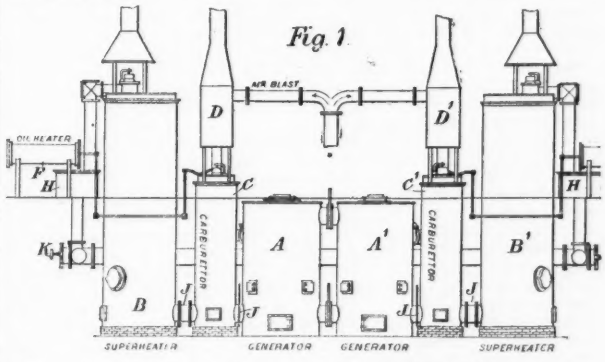
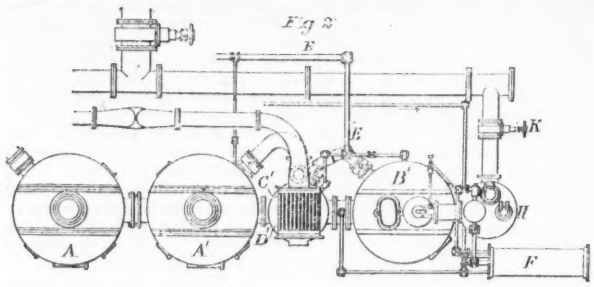
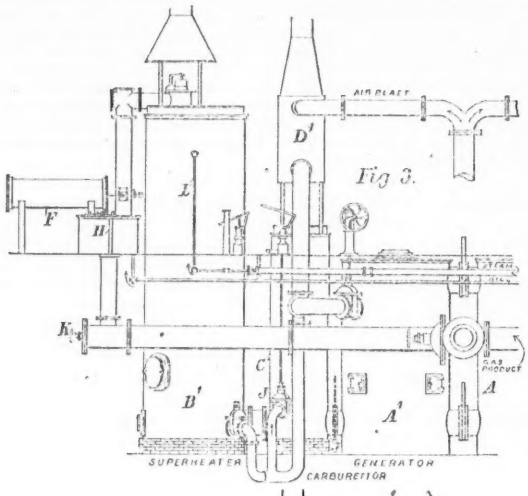
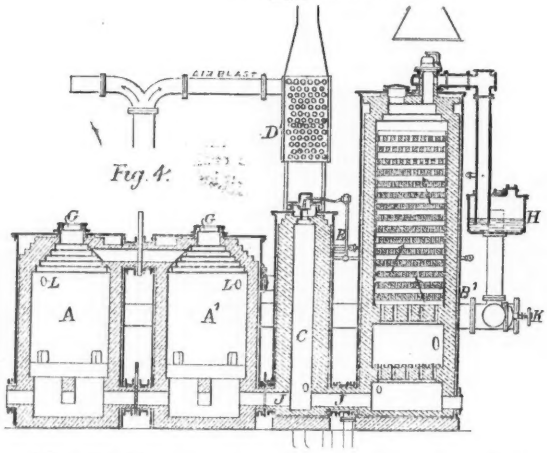


Fig. 1 illustrates, in side elevation, a complete double apparatus embodying this invention. Fig. 2 illustrates a partial plan view of the apparatus. Fig. 3 is a side elevation of one-half of the apparatus, as







viewed from the side opposite to that shown in fig. 1. Fig. 4 illustrates a portion of the apparatus in vertical central section.

The two generators A A^1 are vertical cylindrical structures, provided with tightly-covered feed-ports G. They communicate at their tops by a lateral duct. The two superheaters B B^1 are vertical cylindrical structures, provided internally with fire-bricks, so arranged as to afford an extensive superficial area, and ample intervening passages for steam on its way to a generator, or for gas on its way through the superheater, when operating as a "fixing chamber." Each superheater has at its top an exit or discharge port, guarded by a valve or gate readily opened and closed; and above this port, there is an uptake or chimney. A pipe leads from the top of each superheater to a washer or seal chamber H, and a pipe, provided with a valve K, leads from the washer, for conveying gas to a main or other apparatus—such as purifiers or scrubbers. At its base, each superheater communicates, by a duct J, with the adjacent generator, and preferably with the ashpans or spaces beneath the grates. The duct may be a direct conduit, or it may be partially contained in the base of a carburettor (as shown). This latter arrangement, however, is immaterial, so long as the duct communicates with the interior of the carburettor, as will hereafter be made apparent.

The carburettors C C^1, are vertical cylindrical structures, each heavily lined with fire-brick, and having a tubular interior, unobstructed from top to bottom, and serving as an oil gasifying or vaporizing chamber. At its top this chamber is contracted, and is provided with one of a series of detachable neckpieces or throttlers composed of fire-clay. These throttlers afford annular openings of various sizes; so that the area of the exit-port at the top of the chamber can be varied in its dimensions, for purposes hereafter explained. The discharge or exit port is guarded by a valve, gate, or cap, which can be very readily opened and closed; and above the valve and port there is an uptake or chimney, for conveying away the discharged products of combustion. The interior chamber of the carburettor freely communicates with the duct J, previously described. At the foot of the chamber, and below the line of the duct, an annular space is provided, for the reception of oil in the event of any accidental or undue delivery thereof to the carburettor; and an adjacent hand-hole affords access to the space, if it should ever be required. With the uptakes air-blast heaters D D^1 are employed, through which air is forced on its way to the various portions of the apparatus during the heating up.

Each generator A A^1 has near its top a blast-port L; thus affording a downward blast in each. Near the junction of its interior chamber with the lateral duct J, it has another blast-port; and so also has each superheater near its base. These several blast-pipes adjacent to each of the ports, are provided with suitable valves for graduating the blast, as well as for cutting it off entirely when proper so to do. Steam is supplied from a suitable boiler, by way of a system of piping E, to portions of the apparatus, as follows: To the superheaters B B^1, near their upper ends, and also to the carburettors, by way of jet-pipes. The oil is properly heated before its use in the apparatus, by passing it in contact with the exterior surfaces of the pipes traversed by a portion of the hot gases on their way from the superheaters (when the latter are operating as gas-fixers) to the seal washers H; or the oil may be passed through pipes exposed to the fixed hot gas. In other words, oil-heaters F and F^1 are employed, which in one form are horizontal cylindrical chambers near the superheaters, and connected with a system of oil-pipes provided with suitable cocks.

Referring again to the generators or furnaces A A^1, it is to be understood that, as thus far described, they do not differ materially from prior generators employed in the well-known Lowe process, either in their construction or in their mode of operation. The superheaters or "fixers" in their structure do not differ materially from others heretofore employed; but when considered in connection with a carburettor interposed between the generator and the superheater, the patentee believes it to be new to provide both of them with one or more air-blast ports, whereby sufficient oxygen may be supplied for insuring combustion of gaseous matter passing through each of them while "heating up." These carburettors differ in many respects from the similarly designated portions of any prior apparatus.

In operating the apparatus as thus far described, the patentee would proceed as follows: It being assumed that all the steam-jets and oil-jets and the valves in the gas-pipes beyond the seal washers are closed, also that the exit-ports of both superheaters and both carburettors are wide open, and the generators both charged with solid fuel (such as bituminous coal) properly ignited and their covers tightly applied, the air-blast is first introduced in both generators through the ports L. It thence passes downward through the mass of fuel; thence laterally in two directions, by way of the ducts J; the main portion of the resulting hot gases flowing to and through the two superheaters, and a small portion to and through each of the carburettors. The air-blast is also supplied to each of these at their bases, in proper volumes, until the fuel in the generators has been raised to a proper degree of incandescence, and the superheaters and carburettors are properly heated. The air-blast is then cut off; and all of the exit-ports at the tops of the superheaters and carburettors are closed. One of the gates K in the gas-pipes at one end of the apparatus is then opened; and steam is admitted to the superheater and to the carburettor at the opposite end of the apparatus, whenever it is deemed proper. As the internal pressure increases, the superheated steam is forced to, and then upwards through, the adjacent generator; downward through the other; and thence onward. The gas is enriched in its path by the vaporized and partly gasified oil discharged from the communicating carburettor (in which the oil is vaporized and partially gasified, while descending in free space); and so onward into and through the adjacent superheaters, which then serve as a chamber for fixing the gases.

After a "run" has been made, the steam and the oil jets are closed; the four exit-ports again opened; and the hot blasts applied again to the generators, superheaters, and carburettors, until the apparatus is properly heated—the gas-valve being closed in the meantime. Then another run is made, as described; but preferably reversing the operation of the apparatus, by opening the gas-valve which was before kept closed, and injecting steam at the superheater which before served as a "fixer," and injecting oil, instead of steam, to that carburettor which before served as an auxiliary steam superheater.

The use of the air-blast, highly heated by the discharged columns of the products of combustion, contributes greatly to economy in fuel; and the same is true of pre-heating the oil. The heating of the oil by a corresponding reduction in the temperature of the product gas results in material economy in cooling and scrubbing in the matter of time and water, as will be apparent when it is considered that the heat thus taken from the gas during a working day, ordinarily heats (say) from 4000 to 5000 gallons of oil, to a temperature of about 400° Fahr.

When the oil is injected in proper quantities into the carburettor, it cannot, although discharged therein, in its liquid form, engage with the interior surfaces. In falling, as it does, centrally within a cylindrical chamber, which is sometimes as high as 15 feet, and 18 inches in diameter, and the walls of which are highly heated, even to incandescence, it is thoroughly vaporized and partially gasified, before reaching the base of the carburettors. It is thus in prime condition to be merged with the gaseous product emanating from the superheater and the generators.

The patentee deems it of practical value to avoid the introduction of oil in a liquid form, to passages traversed by the gases which are to be carburetted, as usual heretofore, and also to avoid permitting the oil in a liquid form to lodge upon, or trickle over, interior portions of the apparatus, because by so doing, he is able to maintain all such surfaces in prime condition for giving out the heat desired during a run of gas, as well as for promptly assuming an incandescent or properly heated condition while heating up the apparatus. It will also be found that linings, checker-brick, &c., both in the carburettors and superheaters or "fixers," will do much longer effective duty than when they are exposed to the reception of solid residuary matters, always incident to the contact of oil therewith.

While it is preferable, in the matter of economy and quality of product, to employ the apparatus in its double form, as indicated, it is sometimes arranged so as to enable it to be operated as two separate organizations. In such an event, communication between the generators is wholly cut off, and either generator is supplied with the hot blast and raised to a proper heat—meantime heating up the communicating superheater and also the carburettor, after which the air-

blast is cut off, and the exit-ports closed. Steam is then forced through the incandescent mass of fuel in the generator. The carburettor is operated as when working "double;" but the superheater proper then operates only as a "fixer," and the oil-heater operates in materially cooling the outgoing gas.

Having thus provided for separately operating both halves of the apparatus, the patentee has still further provided for operating both generators in conjunction with either superheater, and the carburettor adjacent thereto. This is accomplished as follows: The ash-pans or spaces below the grates of the generators communicate with each other at a gate-guarded port; and each duct J, near its entrance to these spaces, is provided with a gate for cutting off communication with the generators. Both generators having been supplied with fuel properly ignited, and the duct opened, the blast is applied to both—passing downward therein, through the fuel, into the ash-pans, and forcing the heat from both, into (say) the right-hand duct J, and into and through the right-hand carburettor and superheater, until a proper heat has been obtained. Thereupon the blast is cut off; the exit-ports closed; and steam is then admitted to both generators, and oil is supplied to the right-hand carburettor—the right-hand superheater serving as a "fixer."

APPLICATIONS FOR LETTERS PATENT.

16,646.—HUXLEY, A., "Controlling the supply of gas, &c., to a house or building." Sept. 5.

16,701.—M'MURTRIE, J. M., "Distribution and burning of fluid hydrocarbons for lighting and heating purposes." Sept. 5.

16,745.—HUTCHINSON, S., and BROADBENT, A., "Constructing lamps or lanterns with the parts fitted together with hinged joints." Sept. 6.

16,749.—ARROL, Sir W., and FOULIS, W., "Charging gas and other retorts." Sept. 6.

16,751.—BRUNLER, O., "Device in gas or petroleum engines with slow combustion for ensuring the maintenance of the combustion." Sept. 6.

16,752.—BRUNLER, O., "Ensuring the commencement of the ignition in gas and petroleum engines." Sept. 6.

16,769.—CLARK, F. W., "Extracting naphthalene and other hydrocarbons from coal tar and similar substances." Sept. 6.

16,864.—HOUSE, H. A., sen., HOUSE, H. A., jun., and SYMON, R. R., "Gas or vapour burners and generators for heating purposes." Sept. 7.

Electric Lighting for Wakefield.—The Wakefield City Council agreed last Thursday to make application to the Board of Trade for a Provisional Order, to empower them to supply electricity for lighting purposes.

Bristol Water Company.—The Directors of this Company have declared interim dividends for the half year to June 30 last at the rate of 7½ per cent. per annum on the ordinary shares, and of 5¼ per cent. per annum on the 7 per cent. maximum ordinary stock.

The Electric Light at Morecambe.—The Morecambe Electric Light and Power Company are once more in trouble with the Board of Health. At the monthly meeting of the latter body last Tuesday, the Surveyor presented a report complaining that the Company had not lighted the six lamps on the Marine Road at the time agreed upon; and thereupon the Board resolved to discontinue the use of the electric light altogether.

Portland Water Supply.—Last Tuesday, Colonel W. M. Ducat, R.E., a Local Government Board Inspector, held an inquiry at the Local Board Office, Portland, respecting a proposed new water supply to the island. The Local Authority had applied for sanction to borrow £23,000 for the purpose, the existing sources being very unsatisfactory. A well has already been sunk in the southern part of Portland, and an abundant quantity of water reached. There appears, however, to be some doubt as to the actual yield; and Colonel Ducat was requested to obtain authority for carrying out a pumping test, to determine the quantity actually available. The matter is, therefore, held over until this point is settled.

The Electric Light Question at Torquay.—The Torquay Town Council again considered last Tuesday a proposal to light the town by electricity. The Electric Lighting Committee reported the result of some correspondence between the Town Clerk and Mr. Trentham, an Electrical Engineer. It appeared that the latter estimated the cost of the electric current at 6d. per unit. Details were given as to the cost of the various plans suggested. Mr. Trentham maintained that the high-pressure system was the best for Torquay. The Committee recommended that the Town Clerk should ascertain Mr. Trentham's terms for preparing the necessary specifications and drawings for carrying out the scheme. The estimated cost of the works was £17,403; and maintenance, £3100 per annum. The probable revenue, at 6d. per unit, was set down at £3320 per annum. The Mayor (Mr. W. F. Splatt) moved the adoption of the report; but, after discussion, the Council decided to adjourn the further consideration of the subject for six months.

Victoria Newmarket Gas Company, Limited.—The annual general meeting of this Company was held on the 28th ult., under the presidency of Mr. R. Stephenson. The Directors reported a net balance of £3704 available for division, out of which they recommended a dividend at the rate of 11 per cent., leaving £734 to be carried forward. This was agreed to. The Company's Manager and Secretary (Mr. J. H. Troughton) has lately been in correspondence with the Local Board, on the subject of the public lighting of the town. He pointed out that, owing to the present high price of coal, and the probability of a further rise, the Company could only renew their contract on the same terms as before—viz., 3s. per lamp for 100 hours—if the agreement were for one year; but that, if the Board would enter into a contract for three years, the Company would make a reduction of 1d. per lamp in the case of the ordinary lamps, the others to be supplied on the same terms as before. A suggestion was thrown out that the Board should go on as previously for a year, in the hope of obtaining more liberal terms; but it was explained that, by making the longer contract, a saving of £24 per annum would be effected. This course was eventually agreed to.

CORRESPONDENCE.

[We are not responsible for the opinions expressed by our correspondents.]

The North British Association of Gas Managers and Coal Analyses.

SIR,—I was somewhat surprised at reading the report of the North British Association Committee on "Gas Coal Analyses" contained in your issue of the 1st of August, because the Committee should know better than to issue such a report, and make public either their ignorance or bad workmanship, or that they have been dealing with men who habitually sold them coals of 20 to 40 per cent. less value than they were said to contain. Now I have bought and sold cannel coals for over twenty years, and (what is of more consequence) have worked cannel coals in gas-works—testing them by apparatus which, to say the least of it, is quite as perfect as any I have ever seen; and all my experience is opposed to the finding of the Committee under their first head.

It is well known to the trade that some years ago a gas company in the east country entered into a contract for the supply of a large quantity of cannel coal for delivery over some years—the gas company having the power to send any waggon they pleased (one every month) to be tested by the late Dr. Wallace; the price to be paid being regulated by the quality as ascertained by his analyses. For long, Dr. Wallace made these monthly tests; and never did he find them up or down, to any marked degree, from the printed analysis. The main difference was caused by the season—*i.e.*, the temperature of his condenser, &c. In 1888, Dr. Wallace read a paper on this subject before The Gas Institute, showing that the value of the gas obtained from the cannel rose and fell with the season; the results in the summer months being about 10 per cent. better than those in the winter months. This difference was caused by the temperature of the condensing apparatus, &c. Had the air surrounding the condensing apparatus, been kept at a uniform temperature, little difference would have been seen in the results.

So far as my own experience goes as a tester of cannels, I have worked cannel coals through testing apparatus; and I never found a greater deficiency than 5 per cent. I have also got 4 per cent. above the published analysis. But, mark this, I always took care to see that the coal was clean, and did not contain (as so frequently is the case) stones or common coal, and that my apparatus was in good order.

As a seller of coal, I have had three or four lots of coal, which had been shipped abroad, complained about. In these cases the buyer sent home portions of the cargoes, which were tested by an analyst named by him; and in these cases too the printed analyses were confirmed—indeed, in one case exceeded. Of course, I have had complaints of stones and poor coal getting into waggons, but few indeed, and of little consequence. Stones and bits of poor coal cannot always be prevented being sent away, particularly when the coal is filled when snow is on the ground.

As a buyer of coal, so far as I can remember I have had only once to make serious complaint of bad cannel.

How comes it then that the Committee have given such a finding. I presume that the Committee are all managers of gas-works. I do not know who are on the Committee; for, as you are aware, I retired many years ago from having anything to do with gas making, and therefore speak my mind freely.

In my opinion, there are four principal points that gas managers, as a rule, disregard almost entirely. And here allow me to express my sympathy with you, Sir; for on all these points you have given, over and over again, ample advice—not here a little and there a little, but page upon page, and this too always grounded on results which were not only the outcome of the correct application of theory, but also confirmed by practice. These points are:

1st. How few gas managers put their coals into the retorts dry, although it has been proved that even cannel coals containing little water give 15 per cent. more sperm value when put in the retorts dried. (See Mr. Aitken's paper in the JOURNAL for Nov. 19, 1878.) I see the late Dr. Wallace made the experiments referred to, and few will question any result he arrived at. Besides this, every manager of any knowledge or experience is quite well aware of the advantage of using dried coals.

2nd. If there is one thing to which reference has been made in the JOURNAL oftener than another, it is the evil effects of bringing the cold tar in contact with the gases in condensation. I think it is nearly twenty years since this was very clearly demonstrated. The late Mr. Cusiter, of Dalkeith, conducted some experiments which, I think, proved that cold tars absorbed 25 to 30 per cent. of the illuminating power of the gas. Since these experiments were made, you have printed page after page confirming these results; yet how few have their condensing apparatus constructed so as, even to the smallest extent, to produce in practice the results which can and should be procured by regulating the temperature of the condensers, &c., and thereby keep the benzoles in the gas, and not allow them to go into the tars. I do not overstate the difference in the results to be got by a proper condensing apparatus, as compared with a bad one, at less than from 10 to 25 per cent.; varying with the season—*i.e.*, with the temperature of the air.

3rd. As to the seal in the hydraulic main and the condition of the retorts. How often do you find retorts working in a bad condition, with practically no seal; the consequence being that fire-grate gases pass into the retorts, and so reduce the illuminating power of the gas. I have known the loss of illuminating power under this head exceed 12 per cent. when only one-fifth of the retorts were in bad order.

4th. Is there that amount of attention paid to seeing that the coal is free from stones or what does not properly belong to it? I must say that in nearly all the gas-works I have visited, there seems to be a slackness as to this.

I tell the Committee that, if they will attend to the foregoing points, and otherwise conduct their works in a proper manner, they will get results in actual working within reasonable distance of the published analyses of cannel coal, provided they deal with decent people. Their finding under head No. 1 is a fable, so far as the greater part of the published cannel coal analyses is concerned. I am at one with the

Committee in their finding under the second head; but I have heard complaints of keeping up the old name too long. The Committee's recommendation under the third head is unworkable. A colliery may have half a dozen pits putting out coal of the same (or practically the same) quality, and all sold under the same name; and the Committee should know that a seam of cannel varies quite as much in one pit as in several. Certainly let the name of the colliery always be given, and a certificate sent from the colliery that so much coal was put in waggons so-and-so, and shipped per ship so-and-so. I have seen Scotch cannel coal in London; big pieces being stamped with letters. There could be no mistake about what coal that was meant to be. Certainly the "mixture" business should be stopped, unless when a merchant sells "So-and-So's Mixture;' and then it is quite proper. Some people like blends in whiskey; perhaps some people might like a blend in cannel coals. I dislike both.

As to head No. 4, I am at one with the Committee here; but I must insist in altering the seventh last word, and ask them to substitute the word "*should*" for "*would*." But really unless the 5 tons are honestly selected and really represent the average quality of the cannel, what good is it whether 5 tons or 5 lbs. are tested. There are cannel seams in which the different layers vary in quality 50 per cent.; and it is quite as easy to fill a waggon with the one quality as the other. There are men I would buy coal from on a simple verbal statement; and there are others I would not buy from although they produced analyses by every coal tester in the kingdom.

I hope some of the coal-masters will speak out, and give their ideas on these points; but many of them are afraid of giving offence to gas men, and the gas men are, as a rule, "touchy" persons. Perhaps, however, they feel that the question is one they have not directly to do with. The parties in the fight being the gas analyst and the Committee, who I suppose are *all* gas managers.

The report of this Committee may, in any view of the subject, be looked on as a very one-sided report. Was it fair that the Committee should have been composed entirely of men who had the using of the article? Why did they not put on a coal man or two, and an analyst or two? Both had their good names to look after. Surely, at all events, as a matter of common justice, the Committee, before issuing such a report should have called the gas analysts and the coal men into Court. I venture to say that, had they done so, they would not have issued such a report—the position of matters would have been transposed; and the Committee would themselves have had the coal analysts and some of the coal men as their judges.

ENGINEER.

Sept., 1893.

P.S.—On reading farther in your report, I see the members adopted the report. In the light of recent events, what will members not adopt or pass?

An Improvement in Burners for Gas-Fires.

SIR,—As is well known, a very great objection to the use of gas-fires for heating purposes in houses—more especially in bedrooms, where they are not constantly under direct and immediate supervision—is their liability to "light back." The flame, instead of burning at the nipples of the burner, travels through the mixing chamber, and burns at the gas-jet, supplied by an insufficient amount of air for complete combustion.

There can be no doubt that the recognition by the public of this fault, with its possible ill-effects, does materially restrict the more general use of gas-fires, which are otherwise economical, luxurious, and convenient. The products of the incomplete combustion consist, among other bodies, of acetylene and carbonic oxide, the latter of which, in any degree of concentration, is highly poisonous, and (in more dilute proportions) is capable of producing very unpleasant symptoms for the time being. If frequently inhaled, it might also reasonably produce chronic ill-health.

Before, therefore, medical men can recommend gas-fires for bedroom use, for which they are so admirably adapted, they must have confidence that, in addition to being convenient, economical, &c., they shall possess such a degree of safety as to be practically independent of any supervision whatever for several hours together; or that, if they should require attention, they shall be capable of giving automatic warning. Of the burners now used, this much cannot be said.

It was with the object of surmounting this difficulty that some experiments were recently made by another and myself to determine: (1) The cause or causes of lighting back; (2) to devise, if possible, some means of neutralizing them.

Without enumerating all the attempts that were made in different directions, suffice it to describe one which is of especial interest, inasmuch as it enables us to discover and apply a simple fact, which has not been thought of in this connection—viz., that the "choke damp" resulting from the explosion in lighting back can be utilized to extinguish the flame at the gas-jet, and so allow the mixed air and gas to burn again at the nipple.

The experiment was as follows: Everyone who has used an ordinary Bunsen burner is acquainted with the fact that if, with the air aperture full open, the gas supply be gradually lessened, the flame at length travels down the tube and burns at the gas-jet; and that if the flame be now extinguished, and the air aperture diminished, the Bunsen can be made to burn properly with the same diminished gas supply, without lighting back. An effort was made to apply the same principle to the burner used in gas-fires. A central chamber, fed by two lateral air-tubes (the latter for the purpose of dividing the influence of draught at the air-inlet), was attached to the air-inlet, so as to embrace the tube and tap supplying the gas. On the plug of the tap were fixed two "wings," so arranged that, when the gas was turned low, the wings should at the same time diminish the air supply proportionately. Though the outcome of the experiment was unsatisfactory, in that what was expected did not occur, it was satisfactory and interesting in that it demonstrated the fact that, though the burner did "light back" with a slight explosion (but only after a much more severe test than is ordinarily required for the purpose), the flame immediately recovered itself at the nipples of the burner. The explanation is that the "choke damp" resulting from the explosion in lighting back was collected in the central chamber, and afterwards sucked over the flame at the gas-jet. This extinguished it, and so allowed the succeeding mixture of air and gas to be lighted at the nipples.

By the utilization of this simple fact, it has been possible to devise a burner which is practically safe against a danger present in all gas-fires, as now constructed; and in a short time, when our plans have been completed in all details, we shall be pleased to furnish you with particulars of its construction. Provisional protection has been applied for and granted.

M. D., LOND.

Sept. 11, 1893.

Mr. Winstanley's Arrangement of Hydraulic Mains.

SIR,—Will you allow me permission to call Mr. G. Winstanley's attention to the invention of his hydraulic main, which appeared in the last number of the JOURNAL? At present I do not wish to say anything further than advise Mr. Winstanley to make a small working model, and try it, before he lodges his final specification. No doubt there will be plenty of letters from other gas managers who are well acquainted with the action of the hydraulic main, and will point out the defective parts. Probably there may be a mistake in the drawings supplied. If so, this ought to be put right at once.

R. GOOD.

Carshalton, Sept. 15, 1893.

[We may point out to our correspondent that the description and illustrations of Mr. Winstanley's arrangement, which appeared last week, were prepared from the final specification.—ED. J.G.L.]

LEGAL INTELLIGENCE.

HOUSE OF LORDS.—Friday, Sept. 8.

(*Before the* LORD CHANCELLOR, *Lord* HALSBURY, *Lord* ASHBOURNE, *Lord* WATSON, *Lord* MACNAGHTEN, *and Lord* MORRIS.)

London County Council v. Churchwardens, &c., of Erith and Others. Assessment Committee of St. George's Union v. London County Council. Churchwardens, &c., of West Ham v. London County Council.

These appeals, which had for some time been awaiting decision, involved an important question as to the rateability of the sewage works of the London County Council. The point at issue and the principle enunciated by their Lordships were commented upon in our editorial columns last week; and we now give the full text of the judgment delivered by the Lord Chancellor (Lord Herschell).

The following Counsel were engaged in the case: Sir EDWARD CLARKE, Q.C., M.P., Mr. BOSANQUET, Q.C., and Mr. HORACE AVORY represented the London County Council; Mr. BALFOUR BROWNE, Q.C., Mr. FULLARTON, Q.C., and Mr. MORTON SMITH appeared for the Churchwardens, &c., of Erith and the Assessment Committee of the Dartford Union; and Sir R. E. WEBSTER, Q.C., M.P., Mr. R. T. REID, Q.C., and Mr. J. MONTEFIORE for the Churchwardens, &c., of West Ham.

The LORD CHANCELLOR: The London County Council, by whom the first of these appeals is presented, are the successors of the Metropolitan Board of Works, and are owners of the outfall works, pumping-station, and appurtenances, the rating of which is in question. The sewage south of the Thames is conveyed to Crossness, in the parish of Erith; and for the purpose of discharging it into the Thames, the Metropolitan Board of Works purchased 37 acres of land, and constructed upon it these outfall works, pumping-station, and appurtenances. It was agreed (paragraph 10 of special case) "that if the land, outfall works, and pumping-station in question were not in the possession of the appellants, but in the hands of a private owner, and connected with the Metropolitan sewage system, to be let to the appellants as tenants, they would be willing to pay a yearly rent for the same for the purpose of being used as part of, and in connection with, the Metropolitan sewage system, sufficient to support the gross and net rateable value as fixed by Quarter Sessions, as hereinbefore mentioned; but that, except for the purposes of the Metropolitan sewage system, and if the said works and premises were disconnected therefrom, and, in the hands of a tenant, applied to any other use or purpose they might be available for, the rateable value of the land and premises would be £2678 gross and £2143 net rateable value." The appellants contended: "That the said works, pumping-station, and premises being only capable of beneficial occupation if used for other than the said sewage purposes, should be rated at the value for which the same would let to a hypothetical tenant from year to year, supposing the said works, pumping-station, and premises were not used as part of the said sewage system, but were entirely disconnected therefrom and applied to any other use or purpose for which they could be made available; and that the appellants should be rated according to the rule laid down by the Court of Queen's Bench in *Metropolitan Board of Works v. The Churchwardens and Overseers of the Parish of West Ham* (40 *L.J.*, M.C. 30, L.R. 6, Q.B. 193)." The respondents contended: "That, as the appellants would have been willing to pay a rent for the said works, pumping-station, and premises if they had not been the owners, they must be taken into account as hypothetical tenants from year to year, in order to ascertain the rateable value of the said premises; and that the rule as laid down in *The Burton-on-Trent Corporation v. The Churchwardens and Overseers of the Parish of Egginton* (L.R. 24, Q.B.D. 197, 59 *L.J.*, M.C. 1) governs this case." The Queen's Bench Division gave judgment for the respondents; and this decision was affirmed by the Court of Appeal. No reasons were given in either Court, as the case was regarded as governed by the decision of the Court of Appeal in *The Burton-on-Trent Corporation v. The Churchwardens and Overseers of the Parish of Egginton*. In the case of *The Churchwardens and Overseers of the Poor of the Parish of West Ham v. The London County Council*, which is also before your Lordships for judgment, the question was whether the London County Council were liable to be rated, and, if so, on what basis, in respect of a portion of the main sewers and of the pumping-station situate in the parish of West Ham. So much of the outfall mains or sewers as are in that parish, are constructed in an embankment on land purchased

by the Metropolitan Board of Works, comprising about 37 acres. It was agreed that if the lands, sewers, pumping-station, and works were in the hands of a private person, to be let to the appellants as tenants, they would be willing to pay a sum sufficient to support the gross and rateable value, as determined by the Quarter Sessions; and that, if the land, pumping-station, and works were disconnected from the Metropolitan sewage system, and, in the hands of a tenant, applied to any other use or purpose, the gross estimated rent of the land, pumping-station, and works (exclusive of sewers) was £3125, and the rateable value £2500. The Divisional Court of Queen's Bench affirmed the order of the Quarter Sessions; but the Court of Appeal took a different view. The only question determined by the Court of Appeal was whether the sewers were rateable; whether the other works were rateable or not, was withdrawn from their consideration. The Master of the Rolls thought the sewers were not rateable, because, unless it were the London County Council, no tenant could be found who would give any rent for them, and that the London County Council could not be the hypothetical tenant for two reasons: First, because they had no power to take the sewers on lease; and, secondly, because they must occupy them subject to the restriction that they could make nothing by them. Lord Justice Fry thought that, in order that a hereditament should be rateable, three conditions must be fulfilled. First, there must be an occupier; secondly, a reasonable expectation of letting from year to year to a tenant; thirdly, a reasonable expectation of so letting at a rent of the kind prescribed by the statute of William IV. He came to the conclusion that there was no suggestion of any other hypothetical tenant than the London County Council; and that they were not persons who could be deemed hypothetical tenants, inasmuch as they could not become tenants of sewers. Lord Justice Lopes said that, if it had not been for the School Board case (to which I will refer presently), he should have thought that, being occupiers under such statutory restrictions as those by which they are affected, and bearing in mind the fact that they must suffer a loss from their occupation, the London County Council were not the kind of hypothetical tenant contemplated by the statute. In the case of *The Assessment Committee of the St. George's Union v. The London County Council*, which also stands for judgment in your Lordships' House, the question raised by the special case was precisely the same as that raised in the Erith case. It was found as a fact that, if the London County Council had not been the owners of the lands, works, buildings, pumping-station, and machinery, they would have been willing to pay a rent for them sufficient to support the gross and net rateable value appearing in the valuation list. It was further found that, if the lands, &c., were disconnected from the main drainage system, and in the hands of a tenant who applied them to any other use or purpose for which they might be available, the gross value of the premises would be £1577, and the rateable value £1318. The London County Council contended before the Quarter Sessions that they ought to be rated at this lower value, according to the rule laid down by the Court of Queen's Bench in *The Metropolitan Board of Works v. Churchwardens and Overseers of West Ham* (L.R. 6, Q.B. 193). The respondents here contended that the assessment should be at the higher value. The Queen's Bench Division followed the Erith case, which they considered identical in its facts, and upheld the higher assessment. The Court of Appeal reversed this decision. They held that the case was governed by the West Ham case decided by them, the effect of which I have just stated. In their view no distinction could be drawn between the rateability of sewers and that of lands and pumping-stations, which were part of the sewerage system; that if the one subject were not rateable, it followed that the other was not rateable either. I can see no distinction between the facts of the Erith case and those of the St. George's case; they appear to me to be identical. The judgments of the Court of Appeal in the two cases are, therefore, in direct conflict. The former case was, as I have said, not argued, because it was supposed to be governed by the decision in the Burton-on-Trent case. The distinction drawn between the Burton-on-Trent case, which was argued, and the St. George's case—and, as far as I can see, the only possible distinction—was that, whilst the Court held that in the Burton-on-Trent case the sewerage authority could have become tenants of the land and pumping-stations which they owned, it was not, in the opinion of the Court, within the power of the London County Council to become tenants of the land and pumping-station which belonged to them. I shall have presently to consider the validity of this distinction; but before doing so, it will be convenient to call attention to the decision arrived at by the Court of Queen's Bench in 1868, upon a statement of facts identical with that which came before the Court of Appeal in the Erith and St. George's cases. I refer to the case of *The Queen v. The Metropolitan Board of Works* (L.R. 4, Q.B., 15). Two points were raised in that case: First, whether the main sewers of the Metropolitan Board of Works were rateable; and, secondly, whether a pumping-station and other premises belonging to them were rateable. The Court of Queen's Bench (consisting of Chief Justice Cockburn and Justices Lush, Hannen, and Hayes) held that the sewers were not rateable. With regard to the pumping-station, the Court came to a different conclusion. They held that it was rateable, inasmuch as it had an occupation value. "The Board," said the learned Judge who delivered the judgment of the Court, "must have rented such premises, if they had not become owners of them; and a tenant might easily be found to take them, if the Board were able and willing to let them. A distinction was attempted to be drawn in favour of pumping apparatus, as being a necessary adjunct to the sewers; and it was contended that, as the sewers are not rateable, this adjunct must be exempted as being part of a non-rateable subject. But we cannot accede to this view. The machinery stands on land which is valuable for occupation, and which would undoubtedly be rateable in the hands of any other occupier; and its rateable quality cannot be affected by the particular use to which it is applied by the Board." It may be that the actual judgment in the St. George's case is not at variance with the judgment of the Court of Queen's Bench in the case of *The Queen v. The Metropolitan Board of Works*. The former case was so framed that, if the Court were of opinion that the then appellants ought to be rated according to the rule laid down by the Court of Queen's Bench in the case of *The Metropolitan Board of Works v. The Churchwardens and Overseers of West Ham* (to which I shall have presently to advert), and that the decision of the Court of Quarter Sessions, holding that the London County Council were to be taken into account as possible hypothetical tenants, and that the case was governed by the principles laid down in the Burton-on-Trent case, was erroneous in law, the order of the Quarter Sessions was to be quashed. The judgment in the St. George's case merely quashed the order of Quarter Sessions. It was therefore right, even though the pumping-station were rateable, unless it were, according to the contention of the parish, rateable on the basis that the London County Council were to be taken into account as possible hypothetical tenants. But the Court of Appeal distinctly rested their judgment on the ground that the pumping-station was not rateable any more than the sewers, and that no distinction could be drawn between the two cases; whilst the Court of Queen's Bench, in *The Queen v. The Metropolitan Board of Works*, no less emphatically drew such a distinction, and held the pumping-station to be rateable and the sewers not. The Court of Appeal did not canvass the reasons adduced in the judgment of the Court of Queen's Bench in *The Queen v. The Metropolitan Board of Works* for differentiating the two cases. The Master of the Rolls said that he was not in the least persuaded that the view taken by the Court of Appeal differed from the view which Mr. Justice Lush took. The other learned Judges made no reference to the Queen's Bench judgment. I have said enough to show that the question of the rateability of these pumping-stations is at present in a most unsatisfactory condition. I purpose confining myself, in the first instance, to the question of the rateability of these pumping-stations, and to a consideration, if they be rateable, of the proper mode of assessing them—reserving for discussion at a later period the case of the sewers. The decision of this House in *Jones v. The Mersey Docks* marks an epoch in the law of rating. Many of the earlier decisions are tainted with this vice—that they proceed upon the supposition that lands held for public purposes are on that account not rateable. The doctrine is now exploded; your Lordships' House having distinctly determined that the circumstance that land is held by a public body for public purposes does not affect its rateability. Much reliance was placed in the argument at the bar in the present cases on the language used by Mr. Justice Blackburn in delivering the opinion of the Judges in the Mersey Docks case. The learned Judge said: "It is clear that there can be no valid rate unless the occupation be such as to be of value; and, if the words 'beneficial occupation' are to be understood as merely signifying that the occupation is of value (which is obviously the sense in which the phrase is used in many of the cases cited at the bar), it is clear that a beneficial occupation is essential as the foundation of the rate." The learned Judge, in my opinion, did not and could not have meant that it is essential to rateability that a particular occupier of the land can make a pecuniary profit by the use to which he is putting it. It is, I think, rateable whenever its occupation is of value. At the time when the Metropolitan Board of Works purchased, in the parish of Erith, 37 acres of land for the purposes of their works, the land was, of course, rateable. That it ceased to be so as soon as the Metropolitan Board of Works became the owners, can scarcely be contended. For the purpose of discharging a duty imposed upon them by law, they found it expedient to erect certain buildings upon the land, and to connect them with sewers in other lands belonging to them. I am unable to see how this could produce the result that premises previously rateable ceased to be so. It is found, as a fact, as I have already stated, that if the works were disconnected from the Metropolitan sewage system, and, in the hands of a tenant, applied to any other purpose for which they might be available, their net rateable value would be £2143. Suppose some other system of sewage were adopted, and the pumping station were no longer applied to its present use, I do not think it could be doubted that the London County Council would be rateable in respect of it, and that its rateable value would be at least the sum thus fixed. If so, I cannot think that it is exempt from rateability, at the present time, on account of the particular use to which it is put by the owner—a use which it is clear might be abandoned at any time, if it were thought expedient to do so. No obligation was imposed upon the Metropolitan Board of Works, and none is imposed on the London County Council, of maintaining in existence any particular sewage work. So far I have dealt only with the question of rateability; upon what principle the assessment ought to be made, and what considerations are proper to be taken into account, are questions which, to my mind, are involved in much greater difficulty. In the case of *The Metropolitan Board of Works v. The Churchwardens and Overseers of West Ham*, which came before the Court of Queen's Bench in 1870, the question was raised on what principle the Metropolitan Board of Works were to be assessed in respect of a pumping-station. It was held that they were to be assessed upon the basis of the rent which would be paid by a hypothetical tenant from year to year, supposing the pumping-station were not used for the purpose of main drainage, but was entirely disconnected therefrom, and applied to any other use or purpose for which it could be made available by a tenant. It was admitted by the learned Counsel who appeared in that case for the respondents, that the Metropolitan Board of Works were rateable upon the basis adopted by the Court. Before the Quarter Sessions, the parish had contended that the proper principle to apply in rating property was to treat it as if belonging to, and constructed by a private owner, and in his hands to be let to the Board as yearly tenants; but this contention appears to have been abandoned before the Court of Queen's Bench. The suggestion that a public body who, in discharge of the duties imposed on them by law, have become the owners of land and buildings thereon might be themselves taken into account as possible tenants, was, so far as I am aware, first insisted on in the case of *The Queen v. The School Board for London* (L.R., 17, Q.B.D., 738). The Court of Appeal here held that, in determining what was the rateable value of a School Board building, the School Board might be regarded as possible tenants; and what they would have been willing, had they not been owners, to have paid as rent for the premises might be taken into consideration. The arguments urged at your Lordships' bar in the present case render it necessary to review this decision, and to determine whether it was sound in point of law. The rule which is to govern the assessment of premises to the poor-rate was laid down by the Legislature in 6 and 7 Will. IV., c. 96, s. 1, which

provides that no rate for the relief of the poor should be allowed, or be of any force, which should not be made upon an estimate of the net annual value of the hereditaments rated thereunto—that is to say, of the rent at which the same might reasonably be expected to let from year to year, free of all usual tenants' rates and taxes, and tithe commutation rent-charge, if any, and deducting therefrom the probable average annual cost of the repairs, insurance, and other expenses, if any, necessary to maintain them in a state to command such rent. In the Act to provide for uniformity in the assessment of rateable property in the Metropolis (32 and 33 Vict., c. 67), the term "gross value" is defined as the annual rent which a tenant might reasonably be expected, taking one year with another, to pay for an hereditament, if the tenant undertook to pay all usual tenant's rates and taxes, and tithe commutation rent-charge, if any, and if the landlord undertook to bear the cost of the repairs and insurance, and the other expenses, if any, necessary to maintain the hereditaments in a state to command that rent. The term "rateable value" is defined as meaning "the gross value, after deducting therefrom the probable annual average cost of the repairs, insurance, and other expenses as aforesaid." So far as the question to be determined in this case is concerned, I do not think the terms of the lattter Act are important. "The annual rent which a tenant might reasonably be expected, taking one year with another, to pay for an hereditament," is the same thing as "the rent at which the same might reasonably be expected to let from year to year." It has never been doubted that the rent which is actually being paid by the occupier does not necessarily indicate what is the rent which a tenant might reasonably be expected to pay; or that an owner who is in occupation, and who may not be willing to let on any terms, is none the less rateable. The tenant described by the statute has always been spoken of by the Court as "the hypothetical tenant." Whether the premises are in the occupation of the owner or not, the question to be answered is: Supposing they were vacant and to let, what rent might reasonably be expected to be obtained for them? So far there can, I think, be no difference of opinion. But then arises the question, Is the owner to be regarded as one of the possible tenants, in considering what rent might reasonably be expected? Bearing in mind what was the object of the Legislature in prescribing this test of annual value, I cannot myself entertain any doubt that the owner ought to be thus taken into account. I entirely concur in the decision arrived at by the Court of Appeal, in the case of *The Queen v. The School Board for London*. I think the circumstances of that case when examined are cogent to support the view which there obtained acceptance. If the School Board were to hire buildings for the purpose of establishing a school, it could not be contested that these buildings would be rateable, and that the rent which the School Board paid would be a most important element in determining the sum at which they were to be assessed. If, instead of hiring school buildings, they erect upon land similarly situate like buildings, or if they were to buy the reversion of the buildings they hired, and so became the owners, why, in either of these cases, should the assessment be different? The premises are to them in all these cases of the same value, and their occupation is equally beneficial. Why should the sum at which they are to be assessed to the relief of the poor differ? Again, suppose premises of occupation value for agricultural purposes were to be adapted by the owner for use in connection with the manufacture of some article under a patent process, which he alone was licensed to use, and that, in their then condition, no person would be willing to take them, would the premises cease to be rateable, or be assessable only at a nominal sum, although they might be much more valuable to the owner, and their occupation much more beneficial than if they had remained fit for agriculture, and in a condition to be readily let for that purpose? I cannot think so. These are illustrations. Many others might be adduced, pointing in the same direction, and to my mind conclusively showing that the object of the Legislature in enacting the provisions of the statute of William IV., to which I have always referred, would be defeated, if the question what the owner would have given if the premises had been to let and he had been free to take them, were discarded from consideration. The decision arrived at in the School Board case was followed in the Burton-on-Trent case, which related to a pumping-station in connection with a sewage farm. In the case of *The Mersey Docks and Harbour Board v. The Overseers of Llaneilian*, which was earlier than either of these cases, language was used by some of the learned Judges which it is not easy to reconcile with the decision in the Burton-on-Trent case; and, indeed, I am not sure that the decisions in the two cases are altogether consistent. In the Mersey Docks case, the question to be decided was the rateability of the Mersey Docks and Harbour Board, and the principle upon which they were to be assessed in respect of a lighthouse, telegraph station, buildings, and lands within the parish of Llaneilian. By the Mersey Docks Acts, certain lighthouses theretofore erected, and also a system of telegraphs established for the information and benefit of shipping entering the port of Liverpool, became vested in the Mersey Docks and Harbour Board, to be maintained and worked by them. The lighthouse in question was one of those which had been previously maintained by the Trustees of the Liverpool Docks, and the lease of which, for a term expiring in 1863, became vested in the appellants on their incorporation. The appellants afterwards purchased the freehold of the site of the lighthouse and some adjoining land, and spent a considerable sum in structural improvements of the lighthouse. The Master of the Rolls came to the conclusion, as a matter of fact, that, under the statutes regulating the matter, the Conservancy receipts applicable to the maintenance of the lighthouses could never exceed the Conservancy expenditure. He came, as a consequence, to the conclusion that the hypothetical tenant must rent them subject to the Acts of Parliament, and that, therefore, it would be a profitless occupation, inasmuch as no person who received the earnings could make any profit therefrom. He therefore though that the lighthouse had no beneficial value, and that there could be no beneficial occupation. "That occupation was," he said, "to repeat the phrase we used a short time ago, struck with sterility by the Acts of Parliament." The phrase to which the Master of the Rolls referred was made use of in the case of *The West Bromwich School Board v. The Overseers of West Bromwich*. In that case, the question of the rateability of a School Board in respect of a public elementary school belonging to them was raised for the first time. Expressions were used by some of the learned Judges which do not seem to me to be quite in harmony with the views arrived at, on more mature consideration of the matter, in the case of *The Queen v. The School Board for London*. There is, however, no conflict between the two decisions, inasmuch as the School Board was held rateable. Lord Justice Bowen said: "I will assume that, in the hands of the School Board, it is not capable of being beneficially occupied; but we must consider whether it is capable of being beneficially occupied in the hands of any other person. If land is by law struck with sterility when in any and every body's hands, so that no profit can be derived from the occupation of it, it cannot be rated to the relief of the poor. But if the school-house is not used by this School Board for any profitable purpose, it by no means follows that the site of it must be sterile in every other person's hands." Now, if land is "struck with sterility in any and every body's hands," whether by law or by its inherent condition, so that its occupation is, and would be, of no value to any one, I should quite agree that it cannot be rated to the relief of the poor. But I must demur to the view that the question whether profit (by which, I understand, is meant pecuniary profit) can be derived from the occupation by the occupier is a criterion which determines whether the premises are rateable, and at what amount they should be assessed; and I do not think that a building in the hands of a School Board is incapable of being beneficially occupied by them and is not so occupied because they are prohibited from deriving pecuniary profit from its use. Lord Justice Fry, in the case of *The Queen v. The School Board for London*, said: "The term 'sterility' has been introduced into the cases because as a general rule a profit is produced; but it does not by any means follow that, because there is no profit, there is no value. There could be no better illustration of this than in the present case." I think the learned Judge here points to the true test—whether the occupation be such as to be of value. This is the language used by Lord Blackburn; and I have already said that the possibility of making a pecuniary profit is not in my opinion the test whether the occupation is of value. As the case of the Mersey Docks and Harbour Board was much relied on by the Counsel for the London County Council, I feel bound to say that I cannot agree with the view there adopted—that, because no pecuniary profit could be derived from the conservancy dues to which the Board were entitled in respect of their lighthouse, its occupation was not a beneficial occupation, and had no pecuniary value, or that it was in any sense which could exempt it from rateability "struck with sterility." It appears that the lighthouse had at one time actually been held by the Board as tenants. During that period, its rateability could hardly be in question. Did the Board become less rateable, or assessable on any different basis, because they ceased to be tenants and became the owners? The lighthouse, as it appears to me, was of value to the Dock Board, inasmuch as it assisted to protect from danger vessels which might use their docks and pay them dock dues. I think some confusion has arisen from regarding the term "beneficial occupation" as meaning the same thing as an occupation by which a profit could be earned. As was pointed out by the Court of Queen's Bench in *The Governors of Bristol Poor v. Wait* (5 Adol. and Ell., 1), this is not its meaning when used as a test of rateability. The Governors of the poor of Bristol had taken certain property outside the limits of their city for the purpose of putting out their poor—either simply to lodge them or to employ them at their discretion. In holding the Governors rateable, Lord Denman, Chief Justice, in delivering the considered judgment of the Court of Queen's Bench, said: "The absence of 'beneficial occupation' was also much insisted upon; and it was contended that that is the true criterion to ascertain whether property be rateable or not. It is not to be denied but that this phase 'beneficial occupation' has been in frequent use; and, generally speaking, it serves tolerably well to convey rather a popular notion, than to give a certain rule for deciding the question of rateability in every instance. Because, if by beneficial be meant profitable, or anything like it, the expression is obviously fallacious." There is, no doubt, a certain class of cases in which the amount of profit which can be earned by the occupation of a hereditament is very material in ascertaining the sum at which it should be assessed. In the case of gas-works, water-works, and other industrial undertakings, where a hereditament is enhanced in value by its connection with a profit-bearing undertaking, the profits earned and the share of those profits attributable to any particular hereditament, have to be taken into account; and in such cases as these any restrictions which the law has imposed upon the profit-earning capacity of the undertaking must, of course, be considered. But I do not think this class of cases affords any guide to the assessment of such hereditaments as those with regard to which your Lordships have now to lay down the proper principle of rating. Owing to a statement made in the course of the argument at the bar, I wish, in order to avoid possible misconception, to add a few words as to the method which ought to be followed when it is manifest that an owner would be willing to pay a higher rent than could be obtained from any other tenant. It was said that a practice prevails of taking 5 per cent. on the cost, in the case of buildings, as a basis for arriving at the rental. Such a rule-of-thumb may be all very well where the premises would be likely to find competing tenants, but is not by any means necessarily applicable where it is thought that the owner would be likely to give a higher rental than anyone else. It would often be obvious that he would never be willing to pay the rent arrived at in such a fashion, inasmuch as it would be more advantageous for him to become the owner. There are many other circumstances, too, which may affect the answer to the question what the owner of premises would have been willing to give if, instead of becoming the owner, he had become the tenant of them. In all cases of the description of which I am speaking, the whole of the circumstances and conditions under which the owner has become the occupier must be taken into consideration; and no higher rent must be fixed as the basis of assessment than that which it is believed the owner would really be willing to pay for the occupation of the premises. Having given my reasons for thinking that the judgment of the Court of Appeal in the Burton-on-Trent case was correct, and that the principles there laid down are in accordance with the

law, I turn now to the point which it was thought differentiated the St. George's case from the Burton-on-Trent case—namely, that neither the Metropolitan Board of Works nor the London County Council could, under the statutes which gave them their powers, have become tenants of the pumping-stations, of which they were and are the owners. The point was first glanced at in the judgment of the Master of the Rolls in *The Queen v. The School Board for London*. "If," said the learned Judge, "by the terms of any statute, it" (the School Board) "could not legally be tenant, it would be excluded from the calculation." The view thus suggested was adopted by the Court of Appeal as the ground of their decision in the case of *The Owens College v. The Overseers of Chorlton-upon-Medlock*. The appellants were the Governors of Owens College. The property rated consisted of land purchased by them for the college and college buildings erected and provided by them under the Owens College Act, 1870. The Governors were empowered to acquire and hold land as a site for the college, and other land not exceeding 200 acres. They were also empowered to grant leases of the lands vested in them, except the site of the college. The college could not be carried on as a collegiate institution at a profit in a commercial sense. The lands had been purchased at an expense of £25,000 and upwards; and the buildings had cost more than £125,000. The respondents had assessed the Governors of the college at a rateable value of £3285. The case stated found that, if let for any purposes to which (without considerable structural alterations) they were capable of being turned, they would not let for more than £1300 per annum gross rental. Upon the basis of a rateable value thus arrived at, the college authorities were willing to be assessed. The Master of the Rolls said that, if the college could be considered as possible tenants, that valuation would be wrong. The test for the determination of the case seemed to him to be whether they could legally be tenants of the site for the purposes of the Act; "for if they could not," said the learned Judge, "can it be right to say that what they would give for rent should be taken into accounts?" After giving his reasons for thinking that the site which the Governors were authorized to take was what they were to acquire as owners in fee-simple, the learned Judge proceeded: "If so, it appears to me to follow that they ought not to be taken into consideration as hypothetical tenants. Can it be supposed that the Governors are seeking to become tenants of a site, when the Act of Parliament says they cannot be tenants? It seems to me that the proposition involves the answer to it." The other learned Judges concurred in this view. Lord Justice Bowen said: "It seems to me that they ought to be excluded from the class of persons who might reasonably be expected to give rent for the premises, because they cannot, as matters stand, ever become tenant of the premises for the purposes of a site for the college. A fetter is already imposed upon them; and they can never now hold the premises, except as owners in fee-simple." Lord Justice Fry said: "It seems to me that the result is that the land is dedicated for ever as the site of a building for the college, and that the appellants are incapable of hiring that land for the purposes of the college; and therefore that the contention is well founded that, being prohibited from hiring the land, they cannot be taken into consideration as possible tenants." My Lords, I have stated fully the reasons which led the learned Judges to the conclusion that the Governors of Owens College were to be left out of account as possible tenants, when determining the annual value of the premises occupied by them; and I have most carefully considered these reasons, with all the respect which is justly due to the views of the learned Judges who concurred in them. But I am unable to share the opinion which they expressed. The conclusion arrived at is, in its result, sufficiently startling. Two public bodies might have erected buildings similar in all respects, upon lands similar in situation and of equal value; and these buildings might be occupied in the same way, and applied to the same purposes. And yet, if one of these bodies had power, under the statute constituting it, to hire such buildings, and the other had no such power, the rateable value of the buildings might, and almost certainly would, be different—that is to say, the buildings would have a different annual value; for the words in the statute of William IV., which followed the expression "annual value," only provide a means of arriving at what is the annual value of the premises. Why should the annual or the rateable value of the premises for the purposes of the Poor Law depend upon the statutory power of the owner to take them, supposing he had not been the owner? I am unable to discover any satisfactory reason for this difference; and none seems to me to be suggested by the judgments in the Owens College case. I do not think the distinction drawn can be confined to premises belonging to, and occupied by public bodies for public purposes. A private individual might receive money under an obligation to erect with it a building upon a particular site, to be occupied by him during his lifetime, and with a prohibition against letting to anyone else. If the principle adopted in the Owens College case be a sound one, such an owner would, I presume, be equally excluded from consideration. No attempt was made to show that it was reasonable or just that the distinction drawn in that case should affect the rateability of premises, or their assessment to the poor-rate. It appears to have been thought a necessary consequence of the application to such a case of the rule for the assessment of property laid down by the statute of William IV. No doubt, if this were so, the conclusion reached was a right one, however unsatisfactory or even unjust it might be that the rateability or the assessment of premises in other respects similar, and occupied for similar purposes, should depend upon whether the owner could have taken the premises which he occupied as tenant, or was only enabled to become the owner of them. But having regard to the language used in the statute, and the construction which has been put upon it, I do not myself feel the difficulty by which the Court of Appeal seem to have been pressed. An owner who is in occupation of premises can, of course, never reasonably be expected to take them as tenant from year to year—he cannot become tenant to himself. Yet it has been held that the rent which, if the property were in other hands, he would be willing to pay may be taken into account when inquiring what is its annual value—that is, at what sum it might reasonably be expected to let from year to year. If the hypothesis be admissible, that the owner might himself be amongst the possible tenants—although, as a matter of fact, he could not be so—it seems to me no more violent hypothesis to conceive him as amongst the possible tenants, even although he may be subject to certain legal restrictions which would prevent his becoming so. And, having regard to the scope and object of the enactment in the statute of William IV., I can see no sufficient reason why, if in the one case he may be regarded as the hypothetical tenant, he may not equally be so regarded in the other. It seems to me that a contrary conclusion ought not to be arrived at, unless the provisions of the statute inexorably require it. For these reasons, I am of opinion that the judgement in the St. George's case cannot be supported, even on the assumption that the Court of Appeal rightly held that the London County Council were only empowered to become the owners, and could not, in fact, have become the tenants of the pumping-stations in question. It follows, that in my opinion, the judgement in the case of *The London County Council v. The Churchwardens of Erith* ought to be affirmed, and the appeal dismissed with costs; whilst in the case of *The Assessment Committee of St. George's Union v. The London County Council* the judgement must be reversed, with the usual consequence as to costs. I now turn to the separate case of the rateability of the main outfall sewers in the parish of West Ham; but before dealing with the particular facts relating to the main sewers in that parish, I desire to consider the case generally of the main sewers formerly vested in the Metropolitan Board of Works, and now in the London County Council. It was held, as I have said, that the sewers were not rateable. The ground of the decision was thus put by Mr. Justice Lush, who delivered the judgment of the Court. "We are of opinion that they are not rateable, on the short ground that they are not at present the subject of a beneficial occupation. No payment is made to the Board for the use of them; the rates which they are empowered to levy are for the expense of construction and maintenance, and nothing more. Their occupation yields no profit to the Board, as occupiers, either actual or potential." The effect of this decision was not to establish an exemption of property which down to that time had been rated. By section 135 of 18 and 19 Vict., c. 120, the main sewers then vested in the Commissioners of Sewers of the City of London and in the Metropolitan Commissioners of Sewers, were vested in the Metropolitan Board of Works; and there was at the same time conferred on them the power to construct other sewage works, to prevent the sewage within the Metropolis passing into the Thames near the Metropolis. The case stated by the Court of Quarter Sessions in *The Queen v. The Metropolitan Board of Works* found, as a fact, that neither the late Commissioners of Sewers nor the Metropolitan Board of Works had ever been rated to the relief of the poor in respect of the sewers. It appears, therefore, that for a very long period, both before and since the decision in *The Queen v. The Metropolitan Board of Works*, this particular subject has not been treated as rateable. I cannot regard as altogether satisfactory, in view of the fuller consideration which has since been given to the matter, the grounds upon which the Court of Queen's Bench rested the non-rateability of these sewers. The judgment seems to assume that there can only be a beneficial occupation where it is such as to yield a profit to the public body occupying the premises. I have already said that, in my opinion, the true test is whether the occupation is of value, and not whether it is one by which pecuniary profit can be made. But it would undoubtedly be a serious matter that a hereditament which has for so long a period been deemed free from rateability should, now for the first time, be subjected to it; and there is this peculiarity about the particular subject I am dealing with—until the sewer was made, no rateable subject-matter existed where the sewer now is. If its use as a sewer were abandoned, its rateability would cease; for it is obvious that no person would be willing to take it at any rent. It is not like the case of land previously rateable, which has been adapted to purposes different from those for which it was previously employed, and whose rateable character would not on that account be affected. I cannot pretend that the law of rating is at present in a satisfactory condition, or that, by the application of well-settled principles, the rateability of public bodies in respect of property such as that with which your Lordships are dealing, can be rested upon a sound and consistent basis. In the case of *The Sheffield United Gas Company v. The Overseers of Sheffield* (4 Best and Smith, 735), Mr. Justice Blackburn, after quoting from the observation of Mr. Justice Wightman in the case of *The Queen v. The West Middlesex Water-Works Company* (1 Ellis and Ellis), that there appeared so much difficulty in satisfactorily applying the parochial principle of rating by estimating the rent which a tenant would give for the subject-matter in such a case as that before him, as practically to amount nearly, if not entirely, to an impossibility of doing so satisfactorily; and, after stating that the whole subject-matter appeared to be involved in so much difficulty and uncertainty that the Court had taken much time in considering whether they could not place the rules as to the rating of these companies on more intelligible and satisfactory principles, capable of uniform application, added: "We have not, however, succeeded in laying down a rule which would be consistent with the existing legislation and decisions on the subject, and would at the same time be capable of being satisfactorily worked; and we are strongly impressed with the importance of not unsettling the law as established by past decisions, where we cannot lay down a rule which is not open to exception. On the whole, therefore, we feel that our only course, until the Legislature shall think fit to interfere, is to adhere to the case of *Reg. v. The West Middlesex Water-Works Company*." My Lords, I entirely concur with the learned Judge in deeming it inexpedient to interfere in such a matter as this with a long course of practice, supported by decisions which are not of very recent date. Therefore, even if it be not possible to rest upon grounds altogether satisfactory, the exemption of these sewers, yet the case being, as I have said, a very peculiar one, I could not advise your Lordships to depart from a practice which has prevailed for a very long period, and which has been sanctioned by judicial authority. So far, I have referred to the case of sewers under land, the surface of which was occupied by other persons, and in ordinary course assessed to the poor-rate; but the particular case of the outfall sewer in West Ham is an exceptional one—that sewer is not constructed underground. Thirty-seven acres of land were purchased by the Metropolitan Board of Works for the purpose of this portion of the outfall sewer. The

land so purchased had, down to the time of its purchase, been assessed to the poor-rate. The sewer is carried in an earthen and concrete embankment erected upon the land at an average height of 21 feet above the general surface of the land adjoining. The work thus constructed, therefore, differed from the mere creation of a sewer below the surface of land, which continued afterwards, as before, liable to assessment, but was an adaptation, to the purposes of the Board, of land already occupied and rated. I confess I see the utmost difficulty in distinguishing such an erection as this upon the surface of land from any other erection specially suitable for the purposes of a particular occupier, but which might render it of less value for occupation by other persons not requiring it for that special purpose; and if, in general, owners who occupy land in order to discharge a duty imposed on them by statute may be regarded as amongst the hypothetical tenants, I cannot find any sound basis on which to rest a distinction in favour of the Metropolitan Board of Works, or their successors the London County Council, in respect of this particular use of the land which they own. It was, I am aware, held by the Court of Queen's Bench, in the year 1870, that there was no distinction, for rating purposes, between a sewer underground and one carried upon an embankment. But I have already stated to your Lordships the only ground on which the exemption of the sewers generally can, in my judgment, be rested; and I have pointed out the distiction which exists between an underground sewer and an adaptation of land already rateable to a particular purpose. Mr. Justice Lush stated that the rateable quality of land was not to be determined by what it once was, or by what it might thereafter become, but by what it was at the time the rate was made. I quite agree with this; but if it be the law that the owner of a hereditament may be regarded as amongst the hypothetical tenants, that rule would seem as applicable to the particular erection, whose rateability is the matter in question, as to any other. For these reasons, I am of opinion that, even if the sewers are in general exempt from rateability, the particular sewer work in the parish of West Ham cannot be so treated, and that the judgment of the Court of Appeal must therefore be reversed, and the judgment of the Queen's Bench Division restored; and I move your Lordships accordingly.

Lords WATSON, ASHBOURNE, MACNAGHTEN, and MORRIS concurred.

The result of the judgment was that in the case of *The London County Council v. The Churchwardens, Etc., of Erith and Others* the judgment of the Court of Appeal was affirmed, and the appeal was dismissed with costs; and in the two other cases the decision of the Court of Appeal was reversed with costs.

Adoption of Prepayment Meters in Norwich.—The British Gaslight Company have made arrangements to supply the consumers in Norwich with 3-light prepayment meters.

Landlords' Liability for Water-Rates.—At the Waltham Abbey Petty Sessions last Tuesday, the East London Water Company sued Mr. J. Forster-Alcock to recover £2 6s. 9d. for water-rates in arrear in respect of No. 4, Queen's Villas, Chingford. Mr. G. Kebbell, who appeared for the Company, submitted that the defendant was liable for the rates as owner of a house not exceeding £20 annual value. The defence was that the annual value was £30, and that the tenant was therefore liable. But the Company submitted that there was land adjoining, and let with the house, upon which the water-rate could not be assessed; and that the house by itself was under the annual value of £20. This was borne out by the parochial authorities, who proved that the house was rated to the poor at £16. The novelty of the case consisted in a landlord contending that the Water Company were not charging sufficient. As, owing to the provisions of the Water Companies (Regulation of Powers) Act, 1887, the Company could not cut off the supply, they were at last compelled, when eleven quarters were in arrear, to have the dispute settled in Court. The Magistrates found for the Company.

Disputed Meter Registration.—At the West London Police Court last Wednesday, the Magistrate (Mr. A. C. Plowden) was engaged for a considerable time in endeavouring to ascertain the right amount to be paid by a consumer for a supply of gas by the Brentford Gas Company. There were several summonses for the non-payment of gas-rents; and in nearly all the cases orders were made without opposition. However, in the case of Mr. G. Powell, of Hammersmith Road, an objection was raised to the claim; the defendant alleging that it was based upon the record of a "lying meter." It was admitted by Mr. Emerson, who appeared on behalf of the Company, that the meter was found to be fast; and he said the Company had allowed a deduction of 4 per cent. Defendant submitted that this was not nearly enough, and that it was impossible he could have consumed the quantity of gas charged for. His heaviest quarter never exceeded 25,000 cubic feet; but he was charged for 62,500 cubic feet, Mr. Plowden inquired of Mr. Emerson upon what principle the deduction was made; and he replied because the meter was fast to the extent of 4 per cent. The Magistrate then went into the items, from which it appeared that between Christmas and April 14, on which day the meter was taken away and a new one substituted, the quantity of gas alleged to have been consumed was 53,300 cubic feet. From April 14 the new meter registered correctly. The allowance of 4 per cent., or 2500 cubic feet, had to be deducted from the 53,300 feet. The defendant, who said he had taken up the case, not only on behalf of himself, but in the interest of the public, urged the Magistrate to reduce the claim by one-half, or for a consumption of 25,000 cubic feet, which was equal to his heaviest quarter. He contended that the meter had been fast from the first day he had it; and that, if he had not discovered that it was incorrect, it might have gone on registering incorrectly for twenty years. He called a gas engineer who had examined the fittings and found no escape of gas; and he gave an opinion that the quantity consumed between Christmas and April 14, ought not to have been more than 35,000 cubic feet. Ultimately, Mr. Plowden, who relied upon the evidence of the defendant's witness, gave judgment for 44,200 cubic feet, with 10s. 6d. costs against the Company. The amount claimed was £9 18s. 5d.; but the Magistrate made an order for £7 10s.

MISCELLANEOUS NEWS.

METROPOLITAN WATER SUPPLY COMMISSION.

The Commissioners' Report.

The report of the Commissioners appointed to inquire into the question of the water supply of the Metropolis was presented to the House of Commons last Thursday. It is signed by Lord Balfour of Burleigh (Chairman), Sir G. Bruce, Sir A. Geikie, Professor J. Dewar, Mr. G. H. Hill, Mr. J. Mansergh, and Dr. W. Ogle. We shall, in due course, reproduce the document in its entirety, in order to complete our record of the proceedings in this exhaustive inquiry, which closed on the 30th of June last (see *ante*, p. 91). In the meantime, we are able to give the following summary of the first portion of the report, with the conclusions arrived at by the Commissioners.

After exhaustively reviewing the evidence submitted to them, the Commissioners point out that, in order to preserve the wholesomeness of the water as delivered to the consumer, and in order further to meet the not unnatural sentiment against drinking water which, though wholesome, has been polluted at an early stage, all possible vigilance should be exercised to prevent unnecessary contamination of the Thames and Lea and their respective tributaries; to ensure the thorough treatment of all sewage, before it is allowed to pass into the rivers, by the most efficacious methods that science and experience may dictate; and to enforce the adequate storeage and filtration of such water as is abstracted at the intakes. The Commissioners are convinced that at the present time much filth of various kinds is discharged unnecessarily and illegally into the rivers; and they suggest that steps should be forthwith taken to put matters on a more satisfactory footing. To this end they recommend an increase in the number of sewage farms; and, for the purpose of keeping these farms up to a sufficient standard, they insist upon the necessity for frequent inspection by an authority appointed for the purpose. They place on record the opinion that the Thames Conservancy Acts need simplifying, and that the action of those Acts needs expediting. They also agree that the powers of the Thames Conservancy Board should not be limited to a distance of 10 miles from the main river, but should be extended to the whole course of the tributaries; and that it should be made an offence to pollute a tributary—adding the further recommendation that the staff engaged in inspection should be considerably increased, the necessary funds being provided by the Water Companies or such other bodies as are permitted to take water from the rivers. Although in these remarks the Commissioners specially refer to the Thames, they make it clear that they intend the recommendations to apply equally to the Lea and its tributaries. As to Hertford and the Manifold Ditch, the Commissioners urge that the present condition of affairs should be remedied without delay; but, to achieve the desired result, they point out that it will be necessary to strengthen the hands of whatever authority may be entrusted in future with the prevention of such pollution. As to the alleged pollution of the Lea from gas lime, manure, &c., it is proposed that no collections of manure or refuse should be allowed within a certain specified distance of the river or of any side stream or tributary; and that the duty should be imposed upon some authority of seeing that this prohibition is enforced. The treatment of the water after abstraction from the river is a subject to which the Commissioners have devoted a good deal of attention; and in this connection they suggest that regulations should be drawn up after competent inquiry, and that adherence to these regulations should be strictly enforced. This enforcement should, the Commissioners think, be entrusted to the Water Examiner, who should have a legal right of entry into all the water-works, and upon whom the duty of reporting periodically as to the due observation of the conditions laid down would devolve. The report concludes as follows:—

We are strongly of opinion that the water, as supplied to the consumer in London, is of a very high standard of excellence and of purity, and that it is suitable in quality for all household purposes. We are well aware that a certain prejudice exists against the use of drinking water derived from the Thames and the Lea, because these rivers are liable to pollution, however perfect the subsequent purification, either by natural or artificial means, may be. But, having regard to the experience of London during the last thirty years, and to the evidence given to us on the subject, we do not believe that any danger exists of the spread of disease by the use of this water, provided that there is adequate storeage, and that the water is efficiently filtered before delivery to the consumers.

With respect to the quantity of water which can be obtained within the watersheds of the Thames and the Lea, we are of opinion that, if the proposals we have recommended are adopted, a sufficient supply to meet the wants of the Metropolis for a long time to come may be found without any prejudice to the claims, or material injury to the interests, of any districts outside the area of Greater London. We are of opinion that an average daily supply of 40,000,000 gallons can be obtained from wells and springs in the chalk of the Lea Valley without affecting any material interests; but that, if this quantity be exceeded, it is probable that the springs and wells in the parts of the valley immediately adjacent to the wells and all the districts farther down the valley may be injuriously affected. From wells in the chalk area on the south side of the Thames, in the district of the Kent Company, we are of opinion that a daily average supply of 45,000,000 gallons may be obtained. We think it of very great importance that distinct obligations should be laid upon any company or local authority which is allowed to pump water from the chalk for purposes of public supply to keep accurate observation of the effect of their operations on the level of the water in the wells from which they pump, and return the results to the Water Examiner under such regulations as may be framed.

The great difficulty which we have had to encounter has been in getting accurate and reliable information as to the actual effect of the operations now carried on. The importance of procuring this will increase each year as the limit of what can be taken from any district

with safety is gradually being reached. From the River Lea we are of opinion that, with adequate additions to the present system of storeage, 52,500,000 gallons may be taken daily; we are of opinion that, by the construction of storeage reservoirs in the Thames Valley, at no great distance above the intakes of the Companies, it will be possible to obtain an average daily supply of 300,000,000 gallons without taking in any objectionable part of the flood water. The average daily flow of the Thames at Teddington Weir, adding the water taken by the Companies, is about 1,350,000,000 gallons per day. It will thus be seen that, when 300,000,000 gallons are taken, there will be left to flow down into the tidal portion of the river an average daily quantity of not less than 1,000,000,000 gallons; and we think that regulations could be framed under which the quantity we suggest could be taken, not only without reducing the flow of the river on the rare occasions of exceptional drought to the present minimum, but in such a way as to secure that the volume of water left in the river at these times would be substantially greater than it is under existing conditions.

To our minds, one great advantage of such a scheme is that it can be carried out progressively to meet the increasing demands for water; and, should the population not grow so rapidly as we have thought it right to contemplate, the extensions may be from time to time deferred as successive decennial enumerations reveal that the ratio of increase is remaining stationary or even falling. From the sources and by the methods we have mentioned, a daily supply of 425,000,000 gallons can, in our opinion, be obtained. This is a sufficient quantity to supply 35 gallons per head to a population of 12,142,857 persons, which is nearly a million in excess of what the total population of Greater London will have become in 1931, even if the ratio of increase in the last decennial period to 1891 is fully maintained. We are further of opinion that a large supply of water might be obtained from the chalk area in the basin of the Medway and the district to the east without any risk whatever of damage to that area.

SHEFFIELD UNITED GAS COMPANY.

The Half-Yearly General Meeting of this Company was held last Tuesday—Sir F. T. MAPPIN, Bart., M.P., in the chair.

The report and accounts for the six months ending June 30 last, which were noticed in the JOURNAL for the 22nd ult., having been presented,

The CHAIRMAN moved the adoption of the report. In doing so, he assured the shareholders that this document and the accounts accompanying it presented a true statement of the affairs of the Company. Since they last met, they had had no occasion to make any call on capital account. They had applied for a Provisional Order to enable them, if necessity arose, to issue debenture stock to the extent of £200,000; paying interest at 4 per cent. As the proprietors all knew by the report, the application had been acceded to by the Board of Trade; and they were now in possession of power to do this. They had expended, less depreciation on capital account, a sum of £17,936 during the past half year. A considerable amount of this—£6653—was caused by the large mains that had been laid to Grimesthorpe, to enable them to use two holders that were just completed, one of which had been partially constructed many years ago. This would enable them to take their time in the erection of the large works which he believed they would be called upon to put up at Grimesthorpe in the near future. This was the first occasion, since he had presided at the Company's meetings, that there had been a smaller sale of gas than in the corresponding half of the preceding year. But this was not surprising, as the weather had been such as few of them could remember—bright, sunny, and almost cloudless. Taking this in connection with the general depression in trade, he thought they might feel that the Company were not singular in having sold less gas during the past six months than they had been accustomed to do. The value of the quantity sold less was £3283. They had not realized so much for coke by £2586; having to accept lower prices than they had in previous years. Tar had likewise been a great loss; showing £3146 less than before. On the favourable side, they had a decrease of £6454 in the payment for coal. This, however, was not entirely owing to the price, but to the smaller quantity of gas produced. The repairs of works had come to £2646 less than before; and the repairs of mains and service-pipes had also been £2871 lower. But these reduced amounts they had spent had not been caused by allowing the works to get in a less efficient state; for he believed they were never in a better condition, or more capable of producing the quality of gas required, than they were at the present time. They had evidence of this on all sides; there having been scarcely any complaints from their customers. The shareholders would, he was sure, consider the work for the past half year had been satisfactory when, without making any advance in the price of gas, they were called upon to take only £687 from the reserve fund; leaving the fund at £74,991. But they had power to add to it £11,189, should they, by increasing their profits, be able to do so. He had omitted to state, when speaking of the 30-inch main to Grimesthorpe, that this was 2 miles in extent; that the total length of the new mains laid was 4·92 miles; and that they had relaid 3·87 miles of old mains. The latter had been paid for out of the revenue account. The increase in the number of meters fixed was also satisfactory, and denoted that when they had ordinary weather—and he thought they might say it was not ordinary weather they had experienced this year—they would have a very satisfactory sale. The number fixed during the past twelve months had been 776 more than in the preceding year; and the total number of meters now at work was 50,238. The quality of the gas sent out, as he had already remarked, must be satisfactory, for they had taken during the half year 894 tests, which showed that the illuminating power was equal to 15·98 candles, or 17·46 candles if measured by the "London" Argand burner. In the future, the quality would be measured by that burner, which they now had the power to use under the Provisional Order just obtained. He did not know that it was necessary for him to refer to what was going on in electric lighting, as they knew this quite as well as he did. But, in looking over the JOURNAL OF GAS LIGHTING, he saw some comments respecting the St. Pancras Vestry in London. The Vestry had professed to spend £50,000 upon their Stanhope Street station; but it had actually cost them something like £100,000. Yet with this they found that the production of the light cost double what it was estimated at, and that their loss during the year had been £6500. They further stated, however, that they had saved £1340 in the sum they used to pay for lighting the streets in the usual way. Some of the gas companies, or at all events one of them, had set the example of reducing the price of its gas in London. The South Metropolitan Company, after raising it 3d. per 1000 cubic feet, had found themselves in a position to reduce it 1d. This was a very wise thing, in his opinion, and was only pursuing the policy they had endeavoured to carry out in Sheffield—viz., to maintain their price, without adding to it, and drawing upon the reserve fund to make up the dividend. So far, he thought, they all had cause to be satisfied that they had not raised the price.

Mr. H. HUTCHINSON seconded the motion.

Mr. J. B. WOSTINHOLM said he had noticed, in a report of the proceedings at the meeting of the South Metropolitan Gas Company, that they had commenced to supply the working classes with automatic meters on the "penny-in-the-slot" system; and that the plan had been found to answer very well. He should like to know if the Directors of the Sheffield Company had given any attention to the matter, as he thought it would probably materially increase the supply of gas in cottage houses.

The CHAIRMAN replied that he and the Manager had discussed the question, and he found that already more than half the meters that were fixed were 2-light meters; and they did not think they were called upon to go below this for the present. They would be ready to take the question up when there was need for it; but having 28,000 of the 2-light meters in use, they had hitherto refrained from doing anything. The change would entail a great deal of expense; and, so far as they were able to judge, there had been no necessity to introduce it yet in Sheffield.

The motion was carried.

The CHAIRMAN next moved the payment of the usual dividend, at the rate of 10 per cent. per annum, for the half year ending June 30 last; and the motion was carried.

The retiring Directors (Sir H. Stephenson, Mr. E. Hall, and Mr. W. Mappin) were then re-elected; and the business of the ordinary meeting closed.

A Special Meeting was subsequently held, "for the purpose of authorizing the creation and issuing of £25,000, part of the debenture stock authorized to be created and issued by the Sheffield Gas Order, 1893, which Order had been confirmed by the Gas Orders Confirmation (No. 2) Act, 1893."

The CHAIRMAN explained that the Provisional Order had been granted to the Company, as they found it very important that they should have powers to create debenture stock upon which they could call in the near future to erect large and extensive works at Grimesthorpe. These works would entail considerable outlay before the Company would be able to receive any remuneration from them, or would be able to earn any dividend. The Directors consulted the authorities of the city, who now approved of the Order the Company had obtained. He then moved a resolution to the effect that the sanction of the shareholders and stockholders present at the meeting be given to the creation and issue of £25,000, as stated; the rate of interest to be 4 per cent. per annum.

Mr. W. MAPPIN seconded the motion, and it was agreed to.

A vote of thanks having been accorded to the Chairman and Directors,

The CHAIRMAN, in response thereto, said he could assure the shareholders that it was very gratifying to the Directors to meet them each half year with the same satisfactory report and the same results as had followed their operations for so many years past. When they were able to pay 10 per cent. upon the whole of their called-up capital, and maintain their property, they ought to feel that, in the present state of affairs, they were doing fairly well. He hoped in the future they would do equally well, and that the undertaking would be not only secured, but greatly benefited, by the powers they would be able to use in the creation of 4 per cent. debenture stock. It would, in his opinion, increase the value of the shares, and tend to consolidate the concern. Sir Frederick again thanked the shareholders for the vote; assuring them that it was a great pleasure to him to find he was able to be with them, as he had just passed through an illness more severe than anything he had previously experienced in his life.

The proceedings then terminated.

CARLISLE CORPORATION GAS AND WATER SUPPLY.

Annual Report and Accounts.

The report of the Gas, Water, and Baths Committee of the Carlisle Corporation, with the statement of accounts for the year ending June 30 last, has lately been issued.

In the portion of the report dealing with the Gas Department, the Committee state that the amount expended on capital account, necessitated by the constant increase in the demand for gas, in the past financial year, was £3477, the greater portion of which was for enlarging the gasholder at Bousted's Grassing. It is expected that this will provide sufficient storeage for the next two or three years, after which an additional holder will be required. With the view of improving the system of purification, plant for the production of oxygen, and also of carburetted hydrogen, is in course of construction. The regenerative system of heating retorts has been extended; and during the current year it will be applied throughout the works. Reference is made to the application by the Corporation for a Provisional Order, to enable them to borrow £25,000 for gas-works purposes. This Order was granted on June 29 last; and since then the Local Government Board have sanctioned the raising of £8000, repayable in twenty years. The high prices paid for coals and the low returns obtained for residuals prevented any large increase in profits in the past year. However, they amounted to £3763, as compared with £2973 in 1892 and £3560 in 1891. The Committee deem it advisable to form a reserve fund to

provide for emergencies; and they have allocated £350 thereto. With regard to the Water Department, the Committee report that the capital expenditure on the works during last year was £1920. This was incurred for mains, services, and meters; and as there will be a considerable further outlay on these items in the course of the current year, an early application for an additional loan will be necessary. The revenue from the sale of water continues to increase; and the profit for the past year was £4907, as compared with £4831 in 1892, and £4749 in 1891. The gross profit from the gas and water undertakings was £8670.

The Gas and Water Engineer (Mr. J. Hepworth, M.Inst.C.E.) states, in his report to the Committee, that the works under his charge have been maintained in an efficient condition. The following figures enable comparisons to be made between the past and the preceding year as to the manufacture and sale of gas:—

	1892.	1893.
Coal and cannel carbonized	21,891 tons.	21,530 tons.
Gas made	220,408,000 c. ft.	228,200,000 c. ft.
Do. per ton of coal carbonized	10,068 ,,	10,599 ,,
Gas accounted for	216,150,140 ,,	224 355,300 ,,
Do. not accounted for.	4,257,860 ,,	3,844,700 ,,
Percentage of unaccounted-for gas	1·93	1·36

These figures show that there was an increase of 7,792,000 cubic feet in the quantity of gas made, although there was a decrease of 361 tons in the coal used; that the make per ton was higher by 531 cubic feet; and that the gas unaccounted for was lower by 413,160 cubic feet, or 0·57 per cent. The illuminating power of the gas averaged 19·16 candles. The number of consumers at the end of the financial year was 6301; and there were in use 613 cooking-stoves, 1253 gas-fires and heating-stoves, 372 boiling-stoves, and 45 gas-engines. With respect to the Water Department, Mr. Hepworth reports that the total quantity of water pumped during the twelve months ending June 30 last was 365,637,657 gallons, as compared with 380,328,676 gallons in the preceding year—a decrease of 14,691,019 gallons. The water supplied for domestic purposes was 261,886,657 gallons; for trade purposes, 103,751,000 gallons—the figures for 1891-2 being 280,977,676 gallons and 99,351,000 gallons. The average daily supply for all purposes in the latter year was 24·74 gallons per head of the population; whereas last year it was 23·23 gallons—a decrease of 1·45 gallons.

The accounts accompanying the reports show that in the Gas Department the receipts were £32,219; while the expenditure was £28,455—leaving the above-mentioned sum of £3763 to be carried to the profit and loss account, the balance of which on the 30th of June last was £3076. In the Water Department the receipts were £7521; and the expenses, £2614—leaving £4907 to go to the profit and loss account, the balance of which was £7255.

Mr. Hepworth also presented working statements in regard to the Gas and Water Departments. The former showed that the capital expended on the works and plant amounted at the close of the past financial year to £5 7s. 1d. per ton of coal carbonized, and 10s. 4d. per 1000 cubic feet of gas sold. With respect to the residuals, the quantity of coke made was 9912 tons, of which 7230 tons were sold, at the rate of 10s. 3·4d. per ton net, and 2682 tons were used as fuel. Of tar, 296,628 gallons were produced, or 13·78 gallons per ton of coal carbonized; and it realized, on an average, 0·67d. per gallon. Of sulphate of ammonia, 201 tons 7 cwt. were made—being 18·30 cwt. per 100 tons of coal carbonized; and it fetched, on an average, £5 17s. 10d. per ton. The net proceeds of the coke and other residuals were 35·47 per cent. on the cost of coal. The total cost of coal and working expenses, less residuals, came to 2s. 0·64d. per 1000 cubic feet of gas sold, and 21s. 1·46d. per ton of coal carbonized; the sale of gas, rental of meters, and rents producing at the rate of 2s. 3·95d. and 23s. 11·58d. respectively—showing a profit equal to 3·31d. per 1000 cubic feet of gas sold, and 2s. 10·12d. per ton of coal carbonized. The statement with reference to the Water Department shows that the average daily supply of water for domestic purposes last year was 717,498 gallons; for other purposes, 284,249 gallons—being at the rates of 16·68 gallons and 6·61 gallons respectively per head of the estimated population of the city.

At the Meeting of the Carlisle Town Council last Tuesday—the DEPUTY-MAYOR (Mr. B. Scott) in the chair—the above-mentioned report came up for consideration.

Mr. FORSTER moved the adoption of the report, and of resolutions "that the sum of £3076 16s. 2d., being the balance of profits from the gas-works for the past year, be paid to the credit of the city fund," and "that the sum of £4881 9s. 10d., being the balance of profits from the water-works for the past year, be paid to the credit of the district fund." He said he was pleased to inform the Council that there had been an increase in both the gas and water profits, and that he believed the prospects for next year were very favourable; contracts having been made at low prices. The income from residuals had very much fallen off. Some years ago the Committee realized under this head £3000 a year; but last year only £500 was returned. The money which had been expended at the gas-works, and retained in the hands of the Corporation, was something like £118,000; and all the debt standing against them came to £27,000. The gas-works were in a good position; and he had no doubt that, if no strikes took place at the collieries where they had their contracts, they would have a very successful year.

The DEPUTY-MAYOR seconded the motion; and, after some conversation, it was adopted.

Mr. CROWDER moved a vote of thanks to the Gas and Water Committee for the satisfactory manner in which they had discharged their duties. He added, with regard to the Engineer and Manager of the works, that Mr. Hepworth had been with them for 22 years, and during the whole of that time they had never had to complain of a single accident, or of anything whatever.

Mr. WHITE seconded the motion, and it was agreed to.

THE CRISIS IN THE COAL TRADE.

We continue to-day our record of the most noteworthy events, from our readers' point of view, in the great struggle now going on between the employers and men engaged in the coal-mining industry.

The past week opened with a changed appearance at Dewsbury, where the presence of the military had an appreciable effect upon the miners. Since the previous Saturday there had not been the slightest sign of disorder. On Monday morning a mass meeting of miners took place at Batley Carr; the proceedings throughout being conducted in a very orderly manner. Mr. P. Gledhill, President of the Dewsbury Moor branch of the Miners' Association, was the Chairman; and fully 5000 miners were present. The Chairman expressed regret at the riotous proceedings in the Dewsbury neighbourhood during the latter part of the previous week; and he told the assembly that the cause they were met to further would not be served by such conduct. They were trying to fight the masters like men; and if they were defeated, they would take defeat honourably, and do the best they could under it. The following resolution was carried unanimously: "That we endorse the action of the Miners' Federation in resisting the unjust demands of the coalowners; and, further, that we pledge ourselves to loyally abide by the decision which the Federation may arrive at on Thursday next." A letter from Mr. Crawshaw, a large colliery proprietor in Dewsbury, was read, correcting a misapprehension by stating that not a single ton of coal had been got at any of his pits since the strike began. A speaker stated that the colliers might be defeated in the present struggle; but there was only one way of doing it, and that was by starving them into submission. If they were driven from the field, they would retire in a body. They would alter the 14 days' contract with the masters, and in the winter would return to the battle to demand what might be obtained on this occasion by unjust means. A second resolution, condemning the action of the men of Northumberland and Durham, was passed. In the Wakefield district, all was quiet on Monday evening, and no disturbance was anticipated. No further trouble occurred in the district of Pontefract. Although Derbyshire was comparatively quiet, it was thought advisable to have further military aid there. Balloting in the county on the questions of accepting a reduction, going to arbitration, or allowing work to be resumed where no reduction had been made, resulted in very few affirmative votes being given on the first point, fewer on the second, and only a slight proportion on the third. A demonstration of the miners of the Rishton, Great Harwood, Oswaldtwistle, and other East Lancashire districts, was held at Blackburn, when the following resolution was passed: "That this meeting pledges itself to resist the attempt at the 25 per cent. reduction of the miners' wages as being unjust and uncalled for; also we resist arbitration as an unsatisfactory means of settling disputes—this being based upon the experiences of the last twenty years; and we also believe that royalty rents ought to be abolished." The result of the ballot in the Leigh district showed an ove rwhelming majority against any reduction, arbitration, or returning to work, where possible, at the old rates. The Wigan miners, although the figures had not been officially announced, had, it was stated, almost unanimously come to the same conclusion. A similar decision was arrived at by the Manchester men. In North Staffordshire, 10,000 miners resumed work at the old rate of wages; agreeing to abide by whatever terms might be settled by the Coalowners' and Miners' Federations. The Secretaries of the former body (Messrs. T. Ratcliffe Ellis and E. Parker Rhodes) issued the following statement: "As it is continually being stated that the 25 per cent. reduction asked for by the coalowners means a reduction of 5s. in the pound on present wages, we are instructed by the Executive Committee of the Federated Coalowners again to state emphatically that this is not the case. In 1888–90, advances amounting altogether to 40 per cent. were given upon the standard rate of wages paid in the early part of 1888. The owners now ask the miners to accept a reduction of 25 per cent. on the standard rate of wages paid in 1888, which means a reduction of 17¾ per cent. on the total present wages. After such reduction, wages would then be 15 per cent. higher than before the advance made in 1888."

On Tuesday, unfortunately, there were further disturbances; but they were promptly quelled. At a Council meeting of Derbyshire miners, 15 votes were recorded in favour of accepting the masters' proposal of 25 per cent. reduction, as compared with 19,078 votes against accepting any reduction whatever. At Barnsley, where order prevailed, the men decided, by a large majority, to work at collieries where the owners offered to pay the current rate of wages. A conference of miners representing lodges in the colliery centres of Northumberland and Durham was held at Newcastle, to consider the present position of the coal trade. There were 45 delegates present, representing 12,000 men. They agreed to despatch the following circular to every colliery in Northumberland and Durham, with a request to send delegates to an adjourned meeting on the 20th: "(1) Are you in favour of demanding 15 per cent. for Durham and 16¼ per cent. advance for Northumberland immediately or for a strike; (2) increased financial help to the Midland miners; (3) the leaders of all the counties to get together to consult with each other as to what is best to be done; (4) if the agents do not get the 15 and the 16¼ per cent. advances, that we give in our notices at once?"

The situation was rather grave on Wednesday; the Yorkshire, Derbyshire, and Lancashire Associations having voted against any partial resumption of work. At a conference of the Lancashire and Cheshire Miners' Federation, held in Manchester, the delegates from the various districts represented in the Federation presented their reports upon the recent ballot, which showed that, out of a total membership of about 40,000, only 5214 were in favour of returning to work at the old rate of wages where the employers would allow them, previous to a general settlement of the dispute. The rest were against any reduction, against arbitration, against returning to work on the old scale of payment, and against returning to work until a general settlement permitted all to resume at one time. A meeting was held at the Coal Trade Office, Newcastle, between the Committees of the Durham Coalowners' Association and the Durham Miners' Association, for the purpose of considering the request made by the miners for

an advance in wages; and it was decided not to accede to the request. The result of a ballot taken in the Pelsall district of Staffordshire on the three questions of agreeing to a reduction of 20 per cent., accepting arbitration, or resuming work at the old rate of wages, was announced to-day; 3213 voting in favour of working, and 827 being against all the proposals.

The principal event of Thursday was the meeting of the representatives of the National Federation of Miners at Nottingham. Mr. B. Pickard, M.P., President of the Federation, occupied the chair. The chief business was the reception and discussion of the result of the ballot on the following questions issued by the Executive Committee: Will you agree to 25 per cent. reduction in wages or any part thereof? Will you accept the employers' offer of arbitration? Shall all men resume work who can do so at the old rate of wages? The conference sat the whole day, and then adjourned till the following morning. A resolution was passed unanimously expressing sympathy with the relatives of the men shot at Pontefract, strongly denouncing all rioters as the worst enemies of the miners' cause, and urging the Government to withdraw all imported military and police, on the ground that their presence acted as a forcible incentive to disorder. In the Leeds and Sheffield districts, things wore a peaceful aspect. Durham coal was being imported into Sheffield for the use of several large firms, notwithstanding the high rates that had to be paid for carriage. The Manchester, Sheffield, and Lincolnshire Railway Company were obtaining supplies for their own use from Belgium; bringing the fuel from that country in their own boats, and sending it direct from Grimsby to Sheffield and the various other stations on their line. The London Companies north of the Thames were drawing upon Durham for their supplies; the Great Eastern replenishing their stores from Belgium. At a conference held between representatives of the coal-owners and miners in the Forest of Dean, arrangements were made under which about 4000 men would return to work yesterday.

The delegates of the Miners' Federation met again at Nottingham on Friday, under the presidency of Mr. Pickard. The proceedings, as before, were private; but, after the close of the conference, information was given that the ballot had resulted in an overwhelming majority against the 25 per cent. reduction, and also against the offers of arbitration. As to the third question, there were 61,945 votes in favour of returning to work at the old rate of wages where opportunity offered, and 92,245 votes against. It was officially stated that, upon the three questions submitted to the men, the voting had been as follows: For a 25 per cent. reduction, 226; against, 145,195—majority against, 144,969. For the employers' offer of arbitration, 406; against, 141,566—majority against, 141,160. For the men resuming work where possible, 61,496; against, 92,246—majority against, 30,750. After a consideration of the result of the ballot, the following resolution was carried: "That this conference, after hearing the reports from the districts, and recognizing that this question has been decided by the ballot of the men, advises them to remain firm, as it still believes that a 25 per cent. reduction is unreasonable and uncalled for. At the same time we are prepared to return to work at the old rate of wages, and will meet the owners to discuss, in the interests of the trade, the necessity of their demands being withdrawn." It was agreed that a copy of the resolution should be forwarded to the Secretaries of the Coalowners' Federation; and the conference was adjourned. The men at the small Brierley Hill Colliery, Nottinghamshire, resumed work at the old rates of wages, which the proprietors have arranged to pay till the end of the strike, however long it may last. At a conference of Scottish miners' delegates held in Glasgow, it was decided that the miners' of Stirlingshire, Ayrshire, and Lanarkshire should revert to the four-day policy. Evidence of a spirit of revolt against the Federation was manifest on Friday. At a mass meeting of miners in the Pelsall district, Mr. B. Dean, agent, said that, notwithstanding the decision of the conference at Nottingham, he advised all the men in the district who could resume work at the old rates to do so at once. He added that he had told the ocnferenoe that this would be his advice; and he gave it regardless of the consequences to himself. A resolution approving of this course was heartily adopted; and it was stated that all the employers but two who did not give notice at first would reopen their pits.

At the Stanley pits of the Kilburn Colliery Company in Derbyshire, as well as at several other pits in the county where the 25 per cent. reduction was not sought for, active preparations for a resumption of work were in progress on Saturday. As a body, the colliers employed at the respective pits seemed anxious and willing to resume work at once upon the old terms; yet they hesitated while their fellow-workmen were out on strike. The men in the South Leicestershire coalfields remained firm in their determination not to work, although the strike pay was only 1s. each man. At a mass meeting of trade unionists of Liverpool and the district, Mr. S. Woods, M.P., delivered an address, and proposed a resolution in favour of a legal eight-hour day and work for the unemployed. Referring to the colliers' strike, he said he would die in the streets rather than persuade men to accept the reduction, for he knew that not one-half of the men were earning sufficient to maintain their families respectably. The miners were prepared to fight the battle to the bitter end. They had commercial men trying to betray the employers to the last point, and not allowing them to pay a living wage and give them a profit. It was a question of competition which could be carried too far. The strike could be cut short if the employers were prepared to meet the men; but if they were going to be dictatorial, it would not be cut short. The time was coming when the working men would ask that if the employers could not manage their affairs properly the Government should take the mines and work them for the good of the nation. The resolution was adopted unanimously.

During the past week all the collieries of South Wales and Monmouthshire, with the exception of four small ones, were actively at work. The annual output of the district is about 32 million tons; and it is computed that the total last week, notwithstanding many drawbacks caused through a month's stoppage, reached the full average of about 600,000 tons.

With regard to gas-works, the stock of coal is good at Leicester. At Rochdale, the Chairman of the Gas Committee stated, at the last meeting of the Town Council, that there was no fear of difficulty; and that the Committee were perfectly satisfied with the way in which they had been treated by the contractors. At Ashton-in-Makerfield, however, the Local Board decided, at their meeting yesterday week, to discontinue the lighting of the public lamps, on account of the shortness of the stock of coal at the gas-works.

The Great Northern Railway Company have lately experienced some difficulty, in consequence of the stoppage of their supply of coals from Durham, in keeping up their service; and it has been decided to take off more trains, and reduce local traffic to the lowest possible minimum. With respect to the effect of the strike on other railwaycompanies, it has been reported that the Midland Company have lost £400,000 already, while the total loss of six railways—the Great Northern, Great Eastern, London and North-Western, Midland, Great Western, and Manchester, Sheffield, and Lincolnshire—is put at £1,200,000.

An opinion has been expressed among the colliery agents in the Midlands that the miners will not return to work until the 4th of October.

THE PROGRESS OF THE KESWICK GAS COMPANY.

Mr. J. Hepworth, M.Inst.C.E., Gas and Water Engineer of the Carlisle Corporation, has lately been engaged in making an examination of the accounts of the Keswick Gas Company for the past ten years, and of the results obtained in the Company's works; and he has presented to the Directors a report thereon, from which the following particulars are extracted.

Dealing first with the capital, Mr. Hepworth points out that it was only £6365 in 1883, whereas now it is £11,395—showing a rise of 79 per cent. As it may be necessary to increase the capital at no distant date, in consequence of the growing demand for gas, he suggests that the Directors should avail themselves of their powers to raise loan capital, at a low rate of interest, rather than issue new share capital. Turning next to manufacture, he states that the quantity of gas made in 1883 was 4,673,200 cubic feet, whereas in 1893 it was 11,885,600 cubic feet—being an increase of 7,212,400 cubic feet, or equal to 154 per cent. An increase of capital of 79 per cent. has thus been accompanied by an augmentation of 154 per cent. in the quantity of gas made. Another interesting comparison is shown in the capital employed per million cubic feet of gas made. In 1883 this was £1362; while in 1893 it has been reduced to £958, or 29 per cent. Mr. Hepworth points out that this remarkable result could only have been brought about by the active measures taken to extend the use of gas for cooking and heating purposes, and shows the desirability of still further developing this branch of the Company's business, more especially as they have to compete with electricity for lighting purposes. It is a significant fact, he remarks, that about one-third of the quantity of gas produced at the works throughout the year is employed for cooking and heating, and that the highest daily make is not in winter, as at most other works, but in summer. Coming to profits and dividends, Mr. Hepworth states that in 1883 the profit was £393, and in 1893 it is £730, while in 1889 it was £1016. The reason for the decrease from 1889 was a large reduction in the price of gas. The dividend in 1883 was at the rate of 6½ per cent.; and in 1892, on the same class of capital, it was 8½ per cent., or nearly one-third (30 per cent.) more than in 1883. The shareholders, therefore, after providing further capital, have received an increase in their dividends on that capital. Perhaps the most striking fact of all, however, is that of the great reduction made in the price of gas in the same period. This is shown by the following figures: From 1883 to 1886, the price was 5s. 6d. per 1000 cubic feet; in 1887, it was reduced to 4s. 6d. for lighting and 3s. 6d. for cooking, &c., and it remained at these figures till 1890, when 3d. was taken off; in 1891, the price of lighting gas was reduced to 4s.; and this year it has been brought down to 3s. 3d.—making a total reduction of 2s. 2d., or equal to 40 per cent. The effect of this large reduction is shown on the revenue. The total revenue from the sale of gas in 1883 was £954; in 1892, it amounted to £2035; but, owing to the last reduction in the price, in 1893 it was only £1783. If the price had been the same as in 1883, or even as in 1886, the revenue in 1893 would have been £2985. If the actual revenue—viz., £1783—be deducted from this, it leaves £1202 as the sum annually conceded to the gas consumers as compared with the years preceding 1886, which is equal to a reduction of 40 per cent.; and, as the profits divided by the Company have in no year exceeded £801, the amount now annually conceded to the consumers in the price of gas, as compared with that of ten years since, exceeds by one-half the total amount annually paid to the shareholders in dividend. The number of consumers, which was 310 in 1886, is now 416, or 33 per cent. more. Mr. Hepworth is of opinion that they could be still further increased by the use of "penny-in-the-slot" meters; and he advises that they should be adopted, and that a gas-bracket and a griller or boiling-stove should be fixed and hired out to consumers with the prepayment meter, at a cost to the Company of about 25s. per house, exclusive of the meter. With regard to leakage, it was believed to be about 20 per cent. in 1883. Now it does not exceed 6½ per cent., which is good evidence of the satisfactory condition of the mains, services, and meters. Mr. Hepworth thinks there is probably no gas company in the country which, with such active competition with the electric light as exists in Keswick, can show a similar record of progress and prosperity as that here set forth. He has paid several visits to the Company's works, and has found abundant evidence that they are well looked after; while the results of the balance-sheet continue, he says, to reflect great credit upon the Manager.

The annual general meeting of the Company took place on the 5th inst., when the Directors reported that a sum of £1416 was available for distribution. The receipts for gas were £239 less than those for the year ending June 30, 1892, owing to the large reduction in price already alluded to. However, the Directors expressed the hope that this concession would be appreciated by the consumers, and lead to increased consumption. Dividends at the rates of 8½ per cent. per annum upon the original capital, and £5 19s. upon the additional capital of the Company, were recommended, which would leave £600 to be carried forward.

KENDAL WATER SUPPLY.

The Corporation and the Gas and Water Company.

As already mentioned in the JOURNAL, steps have been taken by the Kendal Corporation to bring about a Local Government Board inquiry into the matter of the water supply of the borough, and the manner in which the Kendal Gas and Water Company are carrying out their statutory powers.

The memorial, which was unanimously adopted at a special meeting of the Town Council, alleges that the Company have not only failed to maintain a sufficient supply of water during the drought, but on other occasions have been similarly wanting. The Company, it is stated, are incorporated by "An Act for better supplying with gas and water the town and parish of Kendal in the county of Westmoreland," which received the Royal Assent on the 26th of June, 1846, and contains the powers and provisions usually comprised in Gas and Water Acts passed before the Water-Works Clauses Act, 1847. Under the powers given in their Act, the Company in 1847 constructed a reservoir now known as the "lower reservoir;" and ten years later they made a second and smaller one, which is known as the "higher reservoir." Water is supplied to the town from these by gravitation. The extent of the drainage area is said by the memorialists to be 240 acres; and they allege that, though the joint capacity of the two reservoirs has been stated to be about 34 million gallons, "the present capacity" is only about 18 million gallons. They go on to say that on Aug. 19, 1868, both reservoirs were exhausted; and the town was left without any supply of water for four or five days. A temporary pumping-station, to supply water from the river, was then hastily made; and this means of supply having been used for five weeks, a permanent pumping-station was put down at Mint's Feet, to aid the gravitation supply in case of drought. In 1879, after a long dry season, the supply of water again failed; and the Company cut a deep drain east of the well attached to the pumping-station, with the result that an additional supply of water was found. Twice in 1891 the water supply again proved defective; and, in order to meet the then difficulty, the Company cut a trench to the River Mint, caused the water from the river to filter through a bed of gravel into a pit which they excavated, and pumped it into the mains. The Medical Officer of Health reported that, having regard to the manufactory and the population higher up the river, this could not possibly be regarded as a suitable source of permanent supply, and that other provision ought certainly to be made. However, in the summer of 1892, resort was again had to the river; and during the drought of the present year a line of pipes has been laid by which water is conveyed by gravitation to the pumping-station, and, after passing through a bank of sand or gravel, is pumped into the mains. The Corporation further allege that neither the River Mint nor the works at the pumping-station at Mint's Feet are within the limits of the plan and book of reference describing the works intended to be executed under the Company's Act. As to the need for a more adequate supply, they point out that the population increased from 12,000 in 1861 to 14,500 in 1891. The water-rental in 1875 was £1789; and it is now £2773. The consumers' taps increased from 2300 in 1868 to 3084 in 1890; and the water-closets from 100 in 1868 to 1200 now. While the consumption and demand for water have thus augmented, the Company have done nothing towards providing a permanent supply; and the Corporation express the opinion that the 240 acres of gathering-ground—the only source of supply recognized by the Company's statutory powers—are insufficient, that the well at Mint's Feet is unreliable in dry weather, and that the water drawn from the Mint is unwholesome, and quite unfit for domestic use.

Windsor Gaslight Company.—The half-yearly meeting of this Company was held last Friday. The Directors reported that the net profits for the six months amounted to £1933. This sum was not so large as usual; but this was accounted for by the reduction, from Oct. 1 last, of the price of gas by 2d. per 1000 cubic feet, which is equivalent to £600 per annum. Owing to the brightness of the last few months, the quantity of gas consumed was much below that for the same period of 1892. However, the amount of money in hand enabled the Board to recommend the payment of the full statutory dividends, and leave a substantial balance to be carried forward. The Directors stated that there were now 158 cooking-stoves out on hire; and it was anticipated that the number would soon be greatly increased.

Commencement of the Nidd Valley Water Scheme.—Last Wednesday, the Bradford Corporation took the initial step in carrying out the additional water-works in the Nidd Valley, for which they have obtained statutory powers, by making a commencement with the Gouthwaite reservoir, which is to compensate the millowners of the valley for the water which the Corporation have now authority to draw upon. The ceremony of cutting the first sod was performed by the Mayoress (Mrs. W. Oddy) in the presence of the members of the Corporation and a number of guests. The Chairman of the Water Committee (Mr. Alderman Holdsworth) gave a short account of the different efforts made by the Corporation, from 1854 downwards, to supply the borough with an abundance of pure water. He then went on to say that the plans for the first Nidd scheme were prepared by their former Water Engineer (Mr. A. R. Binnie, M.Inst.C.E.); but, on his removal to London, he was succeeded by Mr. J. Watson, who, at the suggestion of the Committee, amended the plans, and they then received parliamentary sanction. The water would be collected and distributed by gravitation. The total drainage area over which they had acquired powers is more than 18,000 acres. The Gouthwaite reservoir would cover 330 acres; and the Water Committee were almost ready for following up the inauguration of that part of their scheme by letting contracts for about 32 miles of aqueduct. The ultimate supply for which the complete scheme provided was 32 million gallons daily; and the estimated total cost was £1,330,000. The contract for the reservoir was, in round figures, about £120,000. In selecting the Nidd, as against the other watersheds, he believed they had acted judiciously, both as regards the quantity and quality of the water.

THE DROUGHT AND PROVINCIAL WATER SUPPLIES.

The serious condition of provincial water supplies, owing to the present dry season, which was set forth in the JOURNAL last week, has been rather intensified than relieved in the period which has since elapsed; and even where, thanks to the provision of adequate reservoirs, there is still a good store of water, precautionary measures have been taken to prevent anything like waste. Taking a few towns in their alphabetical order, we find that at Barnard Castle, the reservoir, which holds 900 million gallons when full, and registers a body of 21 feet, contains now only a little more than 5 feet of water. The reservoirs at Bath contained at the close of the past week only about 3 million gallons of water. The springs for the past month decreased in yield from 757 gallons to 725 gallons a minute, or 1,044,000 gallons daily, against 1,259,000 gallons this time last year. The water is now cut off for 15 hours out of the 24. This has reduced the consumption by about 4 gallons per head daily; but, notwithstanding this, the reserve is being drawn upon at the rate of 100,000 gallons a day, so that at this rate the reservoirs will be exhausted in about a month. The facilities for storeage at Bath are limited to 10 million gallons; but contracts are being invited for a reservoir to hold 50 million gallons. In Birmingham, the Water Department have given notice that it will be necessary to curtail the supply, unless there is soon a copious rainfall. The present demand is about 130 million gallons per day, of which something like 7 million gallons come from wells. The reservoirs are capable of holding 600 million gallons; but it is estimated that they do not now contain more than 300 million gallons, and this is being heavily drawn upon, while the deep wells are also being severely taxed. No new water is entering them. In order to put the reservoirs in proper condition, 36 hours' steady rain is needed. The present stock is reckoned to last about a month. In Dublin a serious state of affairs existed last week. At the meeting of the Corporation on Monday, the Lord Mayor (the Right Hon. J. Shanks) called attention to the condition of the Roundwood reservoir. He said that, when the works were originally designed, it was intended that the reservoir should hold at least six months' supply of water, even if no rain fell during that period. This calculation was based on a much smaller area than the present being served. The report of the Engineer to the Water Committee would show how the supply now stood. He stated that the water commenced to fall on the 18th of March last, and had been steadily going down to the present time, when it stood at 22 feet below top-water level. The six months' limit had, therefore, been reached In view of this fact, and acting on the recommendation of the Borough Surveyor, the Water Committee had decided to bring into use the filtered water from the fifth lock of the Grand Canal on the 18th inst., provided there was not, in the meantime, a copious fall of rain. The effect of this would be that, after a considerable period, the Committee would be enabled to extend the supply of the Vartry water to the east side of the city, to a portion of the north side, and to continue the supply, but in an intermittent form, to the townships along the line of route. The announcement that about 130,000 citizens might have to drink the canal water caused something like consternation in the locality affected. In view of the possibility of the canal water being turned on, the Dublin Sanitary Association instructed Professor Tichborne, LL.D., F.C.S., to make an immediate examination of the water above the fifth lock, and, in the event of its being supplied to the city, to report weekly to the Association as to its condition. At Glossop there was in the reservoirs at the end of last week only a few days' stock of water; and the Corporation decided to curtail the supply. In Leeds, last Friday, it was reported that the city had only 24¼ days' ordinary supply of water, as compared with 27 days' supply in the previous week, and 107½ days' supply on the 15th of September last year. By pumping from the Wharfe, the Corporation would be able, if no further rain fell, to supply the inhabitants for 31 days. In the Manchester reservoirs at Woodhead, the stock of water was about equal to 27 days' supply, after making allowance for the water unfit for use. Although the reservoirs at Sheffield are naturally low, there is no apprehension of a failure of the supply if waste is avoided. The quantity of water consumed in domestic and manufacturing operations has for many weeks past averaged nearly 8 million gallons per day; and upwards of 9 million gallons per day has been sent down the Loxley and the Rivelin as compensation to the millowners. This enormous consumption throws a great strain upon the reservoirs; but, notwithstanding this fact, the supply has been maintained without any suggestion of restriction.

Falmouth Gas Company.—The annual general meeting of this Company was held on the 7th inst., Mr. R. M. Tweedy in the chair. In their report, the Directors stated that the consumption of gas in the past twelve months was half a million cubic feet in excess of that of the preceding year; and that, owing to an advantageous purchase of coal, they were enabled to reduce the price of gas 3d. per 1000 cubic feet (bringing it down to 3s. 6d.), with a discount of 2½ per cent. for prompt payment, and a discount of 10 per cent. on gas used for cooking, heating, and motive power, where a separate meter is fixed for registering the quantity consumed. From the net profit for the year, an interim dividend at the rate of 10 per cent. per annum was paid in February last, and it was proposed to pay a further dividend at the same rate; to transfer £168 to the reserve fund; and to carry forward the balance of £54. In moving the adoption of the report, the Chairman animadverted on the action of the Local Authority in curtailing the consumption of gas in the public lamps; thereby giving rise to complaints of inadequate lighting. The Directors tried to induce the authority to make some improvement; but all that had been done had been by the modern lamps erected by the Company at their own expense. With regard to the electric light, if it should be introduced into Falmouth, the Company were quite prepared to undertake it; and they would be able to offer the Corporation better terms than they could obtain from any other source. The motion was unanimously carried. In the complimentary votes with which the meeting closed, the Manager (Mr. J. W. Buckley) and Secretary (Mr. W. Corfield) were included.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Edinburgh and Leith Gas Commissioners, having entered into coal contracts for a year, have—or rather their Works Committee have—resolved to reduce the price of gas from 3s. 10d. to 3s. 6d. per 1000 cubic feet. This is gratifying news, because it looks singular that gas should be had in Glasgow for 2s. 6d., and that in Edinburgh it should be 1s. dearer. Of course, the circumstances explain the difference in price. But the public do not understand this; and the Gas Commissioners suffer in their reputation in consequence. Both in Edinburgh and Glasgow, it is satisfactory to know, the coal contracts were entered into before the troubles with the miners began, otherwise the contract prices might not have been so low. In Fifeshire, where the men struck work, the contracts may be said to have been broken; and coal from there may require to be re-contracted for, if the strike clauses were in the contracts. But it is not anticipated that the results will be materially affected should this be necessary—particularly as sulphate is selling at a good price. In Edinburgh a year ago the price of gas was 4s. 6d. per 1000 cubic feet. It was reduced to 3s. 10d. about this time last year: and now the further reduction of 4d. makes a total reduction, in the course of fifteen months, of 1s. per 1000 cubic feet.

The Valuation Courts this week have not afforded many instances of complaint by the owners of gas-works; but there is one which is worthy of being taken notice of. In the Falkirk district, the Assessor had raised the valuation of the works of the Falkirk Joint-Stock Gas Company from £1661 to £3012. This was done because of the expenditure by the Company of £2934 upon their works. When the case came into Court, the Company's representative agreed to spread the amount of the outlay over five years; and the Court fixed the valuation at £2433. The figures do not work out, taken any way you like, with the principle said to be adopted either by the Assessor or by the Court. But that is nothing; as in these matters there are always deductions to be taken into account. What is important here is that the law of Scotland is now clearly laid down in the matter of the valuation of public works, and is to the effect that the valuation is to be arrived at upon the basis of the net profits—a percentage being allowed to be deducted in name of tenant's profits. Here the Assessor took the actual outlay upon the works; and the Court has allowed it. Of course, the Falkirk Company is a Company earning profits which are divided, and is not in the same position as a Corporation which conducts a public works without profit; but that does not alter the fact that a gas-works, though belonging to a company, are to be valued according to their letting value, and not according to the outlay upon them. The letting value depends more upon the revenue than upon the outlay on the works. That principle is well recognized in the case (say) of mansion houses, where the outlay is on a lavish scale, and out of all proportion to the rent which would be derived if the house were let. Even though the outlay were taken as the basis, I should say that five years is far too short a period over which to spread it. The alterations which have been made by the Falkirk Company are intended to last much longer than five years; if they do not, the investment will have been a most unprofitable one for the Company. The valuation of public works is a matter upon which it has been difficult to arrive at a principle which will work equitably; and I am not enamoured of the established method of taking the profits as the basis, because it puts it into the power of the owner to work the undertaking so as to have no profits, and thus to reduce the valuation to almost nothing. But it is preferable to the method which has been adopted in Falkirk, as it has some semblance of agreement with the requirement of the statute, which is that the subjects are to be valued at what they would let for, "one year with another." If no profits were made, no rent would be derived. Under this Falkirk method, the profits may be large or small—presumably they will be small for a number of years, because of the heavy burden of interest upon an outlay on extensions which will not be fully required for some time. The Company's works would, therefore, let worse instead of better for the first few years. But they have, in these bad years, to pay increased taxation; and then, when they begin to earn a return for the outlay, and the works would let better, the valuation must come down. I take it that, on the expiry of the five years, the valuation, unless there have been further outlays, must return to £1661. This is an anomalous condition of things. Apparently, the Falkirk Company have acquiesced in it, and cannot appeal, but the owners of other gas-works should see to it that this is not made a precedent in the valuation of their undertakings.

In the Lanarkshire Valuation Court yesterday, the subject of the valuation of the ammonia works of the Shotts Iron Company again came up for consideration. Last year it formed the subject of an appeal to the Supreme Court. The circumstances are peculiar. The Furnace Gases Company, of Glasgow, have the right, for ten years, to treat the gases produced in the Shotts Company's works; paying a yearly rent of £40 for the land occupied, and a royalty of 1s. per ton of coal consumed in the Shotts Company's furnaces. The Furnace Company provide the buildings and plant necessary for their work, and may be called upon to remove them, or, at the end of the lease, the Shotts Company may take them over. Last year the Assessor fixed the valuation of the ammonia works at £2500. This sum was reduced to £2000 by the County Committee. When the case was taken to the Supreme Court their Lordships decided that the Furnace Company could not be entered as proprietors, because they were not proprietors, and they could not be entered as tenants, because the buildings and plant were not let to them; and they reduced the valuation to the £40 which is paid for the land occupied. This year the Assessor has entered the subjects at £2400, under the names of the Shotts Company and the Furnace Company jointly. This has been done in respect of the royalty of 1s. per ton of coal, which is "a consideration other than rent." The Assessor stated that he had been refused information as to the amount paid in royalty last year; but he was certain it was more than £2400. The Valuation Committee adopted the principle that the royalty must be taken into account in fixing the valuation. Evidence was then led for the appellants, to show that £2400 was too high; but the Court adopted the Assessor's valuation. An appeal was again intimated. There is no doubt the Assessor is right as to the amount paid in royalties; and, if the appeal be successful, it will establish the fact that it is possible, by attending to the conditions of letting a subject—in this instance, granting a concession—that a profitable industry may escape taxation.

Mr. A. Yuill, the Manager of the Alloa Corporation Gas-Works, who was one of the first to adopt the Peebles process of oil-gas making, has this week brought his oil-gas installation into use. The works were visited yesterday by Provost Thomson and other members of the Corporation; and all were thoroughly satisfied, as Mr. Yuill himself is, with the working of the plant. The installation has been erected to plans prepared by Mr. Yuill. The ironwork was supplied by Messrs. Pearson and Ramage, of Alloa Foundry; the scrubber and washer portion of the plant, by Messrs. Hanna, Donald, and Wilson, of Paisley; and the brickwork has been erected by Mr. John Dennis, of Dalkeith. The oil is received at the works in railway tank-waggons, from which it is run into a storeage tank within the works. It then requires to be pumped to the cistern on the top of the scrubber-washer. A new form of retort has been adopted for the installation at Alloa—the shape being nearly that of a hock bottle, instead of the old cylindrical form. Two ovens have been built—one containing three, and the other two retorts. The retorts are all 8½ feet in length, inside measurement; but the three in the larger oven are 27 inches in diameter at their widest end, while the two in the smaller oven are only 23 inches. They are all made of a uniform thickness of 2 inches; and the iron which has been used is of a close grain, so as to be non-porous. In order to keep a register of the oil gas produced, it is measured before commingling with the coal gas by a circular station meter supplied by Messrs. R. Laidlaw and Son, of Edinburgh.

It is evident that the members of the Town Council of Peterhead are not abreast of the times. This week the Gas Committee recommended that Mr. J. Kincaid, the newly appointed Gas Manager, should be also made collector, at a salary of £20 a year. One of the opponents of the proposal stated that the former Manager, when asked if his time was fully occupied, replied that it was very far from being so; and he (the Councillor) asked why they should not buy in the cheapest and sell in the dearest market. Another said there was not work for a man, and that "to pay a man for half work was too much." The salary of the Gas Manager is £120; and one speaker pointed out that a former Manager had only £60, but that now "they did not know how to coddle these young men." The Gas Committee's recommendation was adopted by a majority. It cannot, however, be a pleasant thing for a gas manager to serve such people. It is certainly open to them to buy in the cheapest and sell in the dearest market; but a cheap gas manager would be a direct reversal of that policy, as everyone connected with gas administration knows. What the gentleman regarded as "coddling these young men" is simply the outcome of the circumstance that gas-works now-a-days require management, and that an old stoker cannot be entrusted with the important work which falls to a gas manager, as once was the case. In Peterhead, apparently, the Councillors are not aware of the very superior class of young men who are do-day offering themselves as gas managers—men with abilities of such a high order that it is really the cheapest policy to offer them a good salary.

The Patent Paraffin Gaslight Company, of Glasgow, who are owners of the Alexander-Patterson process of oil-gas making, the inventors of which are Kirkintilloch gentlemen, have been granted permission by the Police Commissioners "to use the gas-works for testing the illuminating power of ordinary coal gas when mixed with a proportion of oil gas;" and if the results obtained are satisfactory, the Commissioners are to take over the plant. A practical working test of their process is just what the Company want to place them in the running among the crowd of new processes which are seeking admission to gas-works.

Sheriff Erskine Murray has issued a judgment in an action in which a proprietor of house property in Glasgow sought interdict against the use by the defender, a cabinet-maker, of a gas-engine in the adjoining tenement. The engine was complained of by the residents in the pursuer's houses as constituting a nuisance, by reason of the noise and vibration it produced. It had been removed from the other end of the defender's premises to a position near the gable of the pursuer's property. The Sheriff found that it then became a nuisance, though it had not been so before; and he gave the defender time to remove the engine to its former position, or to abate the nuisance. The time having elapsed, he has this week found that, the engine not having been removed, the nuisance still exists, though it is now only intermittent and not continuous. He has therefore granted interdict, with expenses. He holds that the engine might be removed to the other end of the defender's building, though it would not then be so conveniently situated for the defender; and that, the nuisance having only arisen when the engine was brought near to the pursuer's property, it was a case of the nuisance coming to the householder, and not of the householder going to the nuisance.

The St. Andrews Gas Company held their annual meeting on Wednesday; and the report of the Directors was a most satisfactory one—the profit for the year admitting of the payment of the customary dividend of £2 10s. per share, and the setting apart of £500 for new retorts, which are required to enable them to meet an increased consumption of gas. Satisfaction was expressed at the able manner in which Mr. J. Hall manages the affairs of the Company; and a vote of thanks to him was unanimously passed. Mr. Hall, it was stated, has been Manager of the Company for the long period of 43 years.

It seems that the North Berwick Gas Company are dissatisfied with the award of £5145 which was fixed by the Arbitrators (Messrs. R. Mitchell, of Edinburgh, and J. M'Gilchrist, of Dumbarton) as the price to be paid by the Corporation on taking over the Company's undertaking. Provost Brodie on Monday stated to the Town Council that the Gas Company had made representations against the award, but that the Arbitrators had declined to re-open the subject. The fact that the Gas Company were dissatisfied the Provost thought was matter for congratulation, because it showed that the Council had secured the works at a reasonable price. He had no doubt they soon would be able to make a reduction in the price of gas.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Sept.* 16.

Sulphate of Ammonia.—The market has become very irregular, which may be accounted for by the fact that the dealers are the principal buyers; and there is no competition from consumers, who have for the present suspended operations. Immediate parcels still find a ready sale; but considerably lower prices are quoted for late September and early October delivery—nearly £1 per ton less for the latter. It is exceedingly difficult to arrive at a correct estimate in regard to the future, as opinions and operations vary so considerably. Sulphate is freely offered on the Continent on the basis of £13; here there seem to be rather buyers at the price. Spot quotations are between £14 10s. and £14 15s. Hull and Liverpool; and Scotch makes are reported as sold at £14 12s. 6d.

LONDON, *Sept.* 16.

Tar Products.—There is very little life in this market, benzol and the lighter tar products being extremely flat, while the price of carbolic acid does not improve, although the consumption is undoubtedly better. Pitch keeps moderately firm; and considerable business is reported at prices quoted below. Anthracene cannot be obtained under the Tar Products Sales Committee's prices. The improved state of the dyeing trade should help this article materially; the imports of alizarine into the country being much greater than they have been for several years. Prices ruling during the week are: Tar, 12s. 6d. to 14s. Pitch, 24s. 6d. to 25s. 6d. Benzols, 50's and 90's, 1s. 5½d. Creosote salts, 16s. Creosote, 1¼d. Solvent naphtha, 1s. 1¼d. Toluol, 1s. 5d. Crude benzol naphtha, 30 per cent., 7d. Carbolic acid, 60's, 1s. 6d.; crystals, 6½d. Cresol, 1s. 6d. Anthracene, nominal, 30 per cent., "A," 1s. 1d.; "B," 9d.

Sulphate of Ammonia.—The struggle between the "bears" and manufacturers is accentuating itself. There can be little doubt who, in the end, will come off victors, since there are no stocks of sulphate of ammonia, and the production is very considerably less this year. Jobbing lots have changed hands at prices ranging between £14 10s. and £14 15s., less 3½ per cent., according to position. Gas liquor is quoted at 9s. to 10s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The position of the coal trade throughout this district undergoes no material change, so far as any prospect of early settlement of the dispute is concerned; and generally there is very little anticipation that the pits will get to work much before the close of next month. Very few of the Lancashire collieries have now any stocks left; and for these they are asking what may be termed rather "fancy" prices, which are not very readily obtainable, as supplies are coming in pretty freely from Scotland, Durham, and North Staffordshire. Many of the colliery proprietors whose stocks are exhausted have made arrangements for buying coal in the above districts; and fairly large quantities have already been delivered, at prices considerably under what some of the local colliery proprietors are asking. Anything like really fixed quotations are, however, scarcely possible, as prices are so much dependent upon circumstances that they are regulated from day to day. They may be said to average about 17s. 6d. for through-and-through coal, up to 20s. for round coal at the pit mouth, as the quotations of Lancashire coalowners who have anything to offer; whilst through-and-through coal can be bought from other districts, delivered at stations here, at about 17s. to 18s., and round coal at about 19s. 6d. to 20s. 6d. per ton. Of engine fuel, there is so little now left that very special prices have to be paid to obtain supplies—some collieries asking as much as 14s. to 15s. at the pit mouth. With regard to the shipping trade, this has almost entirely passed out of the hands of Lancashire colliery owners; supplies of South Wales and Scotch coal being plentiful at the ports on the Mersey, and at much less prices than are being got on inland sales for local supplies. Although fuel is thus obtainable without much difficulty from other districts, the greatly increased cost is necessarily resulting in a very general restriction of manufacturing operations throughout Lancashire; and though not many works are actually stopped, there are very few that have not partially curtailed their operations.

Northern Coal Trade.—There is still a very strong demand for coal; but the full work in Wales and Scotland, and the recommencement of the collieries in North Staffordshire, has lessened the intensity of the demand for coal in the North-east. The collieries are working very fully; and in some instances there are long turns for additional orders. The employers in the Durham coal trade have refused the request of the men for an advance; and it is probable that a further ballot of the miners may be taken as to the course that is to be pursued. In the meantime, the production in the North is well maintained; and there is a strong demand, only kept in check by the limit of the facilities of carriage. Best Northumbrian steam coals are quoted about 13s. per ton f.o.b.; but more sales are made as the result of special bargaining than at any standard price. Second-class steam coals are about 1s. per ton less; and there is a growing demand for small steam coals for manufacturing purposes—the price being about 5s. per ton, with a tolerably full supply. Gas coals are in rather larger demand. Most of the gas coals are still being delivered on old contracts, at low prices; and the quotation for odd cargoes, where these are obtainable, is on the average from 9s. to 10s. 6d. per ton f.o.b. Manufacturing coal varies much in demand—some of the collieries in Durham having very heavy orders in hand from the Yorkshire manufacturing districts, while others report only a limited demand. Coke is still rather quiet, at from 15s. 6d. to 16s. per ton for export; the local demand remaining steady. Gas coke shows no alteration in price; but the output is now increasing.

Scotch Coal Trade.—The miner is an unstable quantity. It was thought last week that all trouble was over with the men in Scotland; but the proposal of the masters to consider as to reducing their wages, has driven the west-country men into revolt, and they have at once adopted the restrictive policy of working only four days a week. While they were working full time, the masters felt themselves safe in accepting forward orders at lower rates; and a large trade was being done. Now the masters are chary of taking forward contracts; and consequently prices are showing a tendency to rise again, and the trade is less. Probably the masters were premature in speaking of a reduction of wages so long as the strike in England lasted, because the effect has been to cripple their own trade. The fresh conflict which is threatening is disappointing; and it may end in unpleasantness. In Fife and the Lothians, there is at present harmony. The arbitration in the Lothians is proceeding; and the men, with few exceptions, are at work. In Fifeshire, too, there is one pit—the Rosewell Gas Coal Company's—where there is some trouble regarding wages. Otherwise the output in both districts is large, and the demand good. Prices have, however, generally receded from what they were two weeks ago, and are given as: Main, 8s. to 8s. 6d.; ell, 9s. to 9s. 6d.; splint, 9s. to 9s. 6d.; and steam, 10s. 3d. to 11s. per ton f.o.b. Glasgow. Shipments for the week amounted to 180,568 tons—an increase over the preceding six days of 5539 tons, and as compared with the corresponding week of last year of 17,445 tons. For the year to date, the total shipments have been 4,863,636 onts—a decrease compared with the same peirod of last year of 337,515 tons.

The Water Supply of St. Austell.—The St. Austell Local Board last Tuesday decided to apply to the Local Government Board for power to borrow £3500 to carry out a scheme of water supply, which will include the construction of a service reservoir at Trenance to contain a million gallons.

West's Coal Breaking and Conveying Machinery for the Salford Gas-Works.—The Gas Committee of the Salford Corporation have accepted the tender of West's Gas Improvement Company, Limited, for the supply of coal breaking, elevating, and conveying machinery, for dealing with the coal in connection with the installation of inclined retorts which is at present in course of construction at their Liverpool Street station. The machinery includes a very powerful cannel-breaker of the same kind as those now being made by the Company for the Bradford Road works of the Manchester Corporation. This type of breaker has been specially designed for dealing with cannel and other hard coal and large lumps; and it will be the most powerful breaker ever manufactured for dealing with raw material in gas-works.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 527.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	13 Apl.	10½	Alliance & Dublin 10 p. c.	10	17½–18½	..	5 13 6
100,000	10	,,	7½	Do. 7 p.c	10	12–13	..	5 15 4
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	102–104	..	4 16 2
100,000	20	31 May	8	Bahia, Limited	20	10½–11½	..	13 18 3
200,000	5	12 May	6½	Bombay, Limited	5	5½–6	+⅛	5 8 4
40,000	5	,,	6½	Do. New	4	3¾–4¼	+¼	5 13 0
380,000	Stck.	16 Aug.	11½	Brentford Consolidated	100	217–222	..	5 3 7
180,000	,,	,,	8½	Do. New	100	163–168	..	5 1 2
220,000	20	15 Sept	11½	Brighton & Hove Original	20	40–42*	..	5 9 6
888,500	Stck.	31 Aug.	5	Bristol	100	102–105	..	4 15 3
320,000	20	13 Apl.	11½	British	20	42–44	..	5 4 7
50,000	10	31 Aug.	11½	Bromley, Ordinary 10 p. c.	10	19–20	..	5 15 0
51,510	10	,,	8½	Do. 7 p. c.	10	15–16	..	5 6 3
328,750	10	28 July	2	Buenos Ayres (New) Limited	10	5¼–6½	..	3 1 6
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	97–100	..	6 0 0
150,000	20	13 July	8	Cagliari, Limited	20	25–27	..	5 18 6
550,000	Stck.	28 Apl.	12½	Commercial, Old Stock	100	243–248	..	5 0 10
165,000	,,	,,	9½	Do. New do.	100	185–190	..	5 0 0
160,762	,,	15 June	4½	Do. 4½ p. c. Deb. do.	100	125–130	..	3 9 3
800,000	Stck.	15 June	13	Continental Union, Limited	100	230–235	..	5 10 7
200,000	,,	,,	10	Do. 7 p. c. Pref	100	191–196	..	5 2 0
75,000	Stck.	15 Sept.	10	Crystal Palace District	100	185–190*	..	5 5 3
486,090	10	28 July	10	European, Limited	10	21–22	..	4 10 11
354,060	10	,,	10	Do. Partly paid	7½	15–16	..	4 13 9
5,646,590	Stck.	16 Aug.	12	Gaslight & Coke, A, Ordinary	100	227–232	+2	5 3 6
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	95–100	..	4 0 0
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	261–266	..	3 15 2
30,000	,,	,,	5	Do. F, 5 p. c. Pri.	100	120–125	..	4 0 0
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	175–180	..	4 3 4
1,300,000	,,	,,	7	Do. H, 7 p. c. max	100	168–173	..	4 0 11
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	260–265	..	3 15 6
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	155–160	..	3 15 0
1,061,150	,,	15 June	4	Do. 4 p. c. Deb. Stk.	100	126–129	..	3 2 0
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	128–132	..	3 8 2
908,000	,,	,,	6	Do. 6 p. c. do	100	172–177	..	3 7 9
3,800,000	Stck.	12 May	12	Imperial Continental	100	226–231	+2	5 4 0
75,000	5	15 June	6	Malta & Mediterranean, Ltd.	5	5⅛–5⅜	+⅛	5 4 4
560,000	100	4 Apl.	5	Met. of Melbourne, 5p. c. Deb.	100	104–106	..	4 14 4
541,920	20	15 June	5	Monte Video, Limited	20	12¾–13⅜	..	7 8 2
150,000	5	31 May	10	Oriental, Limited	5	7⅞–8	..	6 5 0
60,000	5	29 Mar.	7	Ottoman, Limited	5	4–4½	..	7 15 6
166,870	10	—	2	Pará Limited	10	2–2½	..	—
420,000	100	2 May	6	People's Gas of Chicago— 1st Mtg. Bds.	100	100–105	..	5 14 3
500,000	100	1 June	6	2nd Do.	100	98–102	..	5 17 8
150,000	10	28 Apl.	5	San Paulo, Limited	10	8–9	–⅛	5 11 1
500,000	Stck.	31 Aug.	15½	South Metropolitan, A Stock	100	295–300	+3	5 3 4
1,350,000	,,	,,	12	Do. B do.	100	244–249	+2	4 16 4
260,000	,,	,,	13	Do. C do.	100	250–255	+3	5 1 11
750,000	,,	13 July	5	Do. 5 p. c. Deb. Stk.	100	148–152	..	3 5 9
60,000	Stck.	31 Aug.	11½	Tottenham & Edm'nton, "A"	100	210–215	..	5 7 9
				WATER COMPANIES.				
744,897	Stck.	29 June	10	Chelsea, Ordinary	100	265–270	+2	3 14 1
1,720,252	Stck.	29 Mar.	8	East London, Ordinary	100	214–219	+1	3 13 1
544,440	,,	29 June	4½	Do. 4½ p. c. Deb. Stk.	100	140–145	..	3 2 11
700,000	50	15 June	8½	Grand Junction	50	109–112	–1	3 15 10
708,000	Stck.	16 Aug.	11	Kent	100	277–282	+2	3 18 0
1,043,800	100	29 June	9½	Lambeth, 10 p. c. max.	100	241–246	+2	3 17 3
406,200	100	,,	7½	Do. 7½ p. c. max.	100	197–202	..	3 14 6
310,000	Stck.	29 Mar.	4	Do. 4 p. c. Deb. Stk.	100	129–132	..	3 0 7
500,000	100	16 Aug.	12½	New River, New Shares	100	327–332	+2	3 13 2
1,000,000	Stck.	28 July	4	Do. 4 p. c. Deb. Stk	100	132–135	..	2 19 3
902,300	Stck.	15 June	6	S'thwk & V'xhall, 10 p. c. max.	100	150–155	+1	3 17 6
126,500	100	,,	6	Do. D 7½ p. c. do.	100	140–145	..	4 2 9
1,155,066	Stck.	15 June	10	West Middlesex	100	260–265	+2	3 15 6

*Ex Div

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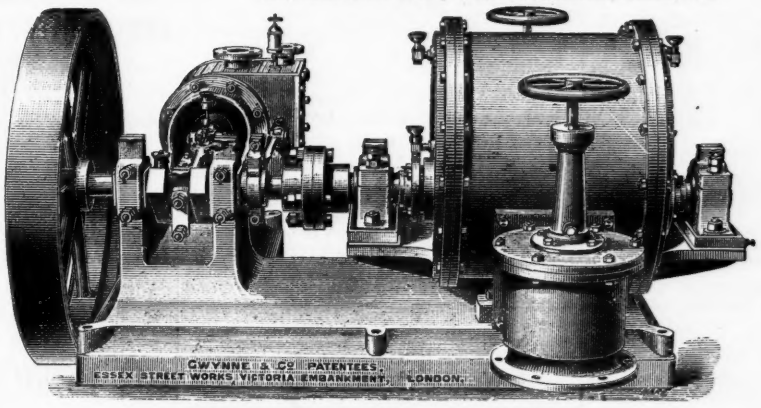

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FOR SALE—Two Drawing and Two Charging hand-power STOKING-MACHINES by West's Gas Improvement Company, capable of working Retorts up to 6 feet from Stage Level, with a maximum charge of 3 cwt. per Mouthpiece. In thoroughly good working condition, complete with Travelling Scoops and Hoppers, spare Rake-Heads, Rods, Propelling Gear, &c., &c.; but with no Rails, Coal-Breakers, or Lifting Machinery.
To be seen at the Kent Road Works of the South Metropolitan Gas Company, and offered at a very low price.

SPECIAL BARGAIN.

FOR SALE—A perfectly new 30,000 feet per hour HORIZONTAL DOUBLE PUMP RECIPROCATING EXHAUSTER, with Steam-Engine, with Connections and Valves.
One Second-hand (thoroughly overhauled) VERTICAL PUMP EXHAUSTER, with Steam-Engine (with clean Water and Liquor Pumps attached), to pass 7000 cubic feet of Gas per hour.
The whole of the above plant can be inspected, and full particulars with prices will be sent, on application to No. 2241, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

G. L. LAMBERT, 26, Alberta Terrace, Nottingham. Consultations, Advice, Reports in Various Branches of **Practical** Mechanical Engineering and Machinery. **Specialities** in Water, Sewage, and Gas Plant Making. **Surveyor** of Steam-Ships, Marine Engines, Boilers, and General Machinery. **Detailed Inspection** of Engineering Contracts during Manufacturing and Erection.

PURIFIERS.

FOR SALE—Four 5 feet Square PURIFIERS, in good condition, lying at Filey.
Apply to HENRY TOBEY, Gas-Works, MALTON.

FOR SALE, cheap—A round Station METER (6-inch Connections), with three Valves and Tees forming Bye-Pass. Is now being taken down to admit of a larger one being fixed.
Apply to A. THOMAS, Gas-Works, COWES.

TENDERS wanted for about 2000 tons of Flint Colliery CANNEL, in stock at Colliery. Price to include loading into Trucks. Analysis on application.
Apply to the NEW FLINT COAL AND CANNEL COMPANY, 5, Windsor Buildings, George Street, LIVERPOOL.

TO MANUFACTURING CHEMISTS.

THE Directors of the Rastrick Gas Com- pany invite TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR produced at their Works during the ensuing Twelve Months, from the 1st of October next.
Tenders, stating price per ton, and endorsed "Tender for Tar and Liquor," to be delivered at the Company's Office not later than Monday, Oct. 2.
The Directors do not bind themselves to accept the highest or any tender.
ALFRED WEST,
Manager and Secretary.
Gas Offices, Rastrick,
Sept. 16, 1893.

CORPORATION OF LEICESTER.

ELECTRIC LIGHTING CENTRAL STATION.
IRON ROOFING.

THE Gas Committee of the above Cor- poration are prepared to receive TENDERS for the supply and erection of two ROOFS, one 139 ft. long, 40 ft. span, and one 60 ft. long, 40 ft. span.
Drawings may be seen and Specification and Form of Tender obtained, upon application to the Engineer.
Tenders, addressed to Alderman Lennard, Chairman, and endorsed "Tender for Roofs," to be delivered at these Offices, not later than Eleven o'clock a.m., on Saturday, Sept. 23.
The Committee do not bind themselves to accept the lowest or any tender.
ALFRED COLSON, M. Inst. C.E.,
Engineer and Manager.
Gas Offices, Millstone Lane,
Leicester, Sept. 1, 1893.

LONDON COUNTY ASYLUM, COLNEY HATCH, N.

THE Sub-Committee for the Control and Management of the above-named Asylum are prepared to receive an OFFER for the purchase of TAR and AMMONIACAL LIQUOR for the Twelve Months ending Sept. 30, 1894.
Terms: Cash on removal.
Forms of Tender, containing estimated quantities for Sale, may be obtained at the Office of the Asylum's Committee, 21, Whitehall Place, S.W., where such tenders, duly filled up, must be sent, in sealed covers, marked "Tender for Purchase of Gas Tar, &c.," to the undersigned, by or before Twelve o'clock Noon, on Thursday, the 21st of September.
The person or firm whose tender is accepted will be communicated with.
R. W. PARTRIDGE,
Clerk of the Asylum's Committee.
London Asylum's Committee Office:
21, Whitehall Place, London, S.W.,
Sept. 9, 1893.

SALE OF GAS COKE AND BREEZE AT THE ROYAL ARSENAL, WOOLWICH.

THE Secretary of State for War is pre- pared to receive TENDERS for the purchase of such quantities of GAS COKE and BREEZE as may be for disposal during the period of One Year from the 1st of October, 1893, at the Royal Arsenal, Woolwich, where Forms of Tender and all Information may be obtained, on application to the Superintendent of Building Works.
Parties tendering will be at liberty to submit offers for either the Coke or the Breeze, or for both, and are requested to make themselves acquainted with the mode of measurement at the Royal Gas Factory.
The Tenders are to be delivered at the War Office, Pall Mall, S.W., by Twelve o'clock Noon, on Wednesday, the 27th day of September, 1893, addressed to the Director of Army Contracts, and Marked on the outside "Tender for the Purchase of Coke and Breeze."
G. LAWSON,
Director of Army Contracts.
War Office, Pall Mall, S.W.,
Sept. 13, 1893.

COMMERCIAL GAS COMPANY.

NOTICE is hereby given, that an ORDINARY MEETING of the Commercial Gas Company will be holden at the Cannon Street Hotel, in the City of London, on Thursday, the 5th of October, 1893, at Twelve o'clock at Noon—
To receive the Report of the Directors,
To declare a Dividend,
And for other Business.
The Stock Transfer Books will be closed from the 22nd of September inst. to the 5th of October next, both days inclusive.
By order of the Board,
H. D. ELLIS,
Secretary.
Offices: Stepney,
Sept. 12, 1893.

EAST LONDON WATER-WORKS COMPANY.

NOTICE is hereby given, that the Half- Yearly Assembly of Proprietors will be held at the Company's Office, St. Helen's Place, Bishopsgate, E.C., on Thursday, the 5th of October, 1893, at Twelve o'clock noon precisely, pursuant to Act of Parliament.
The Transfer Books in respect of the Ordinary Stock will be closed on the 21st of September, and re-opened on the 12th of October, on which day the Dividends on this Stock will be payable.
By order,
J. A. CROOKENDEN,
Secretary.
St. Helen's Place, E.C.,
Sept. 12, 1893.

BRITISH GASLIGHT COMPANY, LIMITED.

NOTICE is hereby given, that the HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors of this Company will be held at this Office on Wednesday, the 27th inst., at half-past Twelve o'clock precisely, to transact the usual Business, to declare a Dividend for the Half Year ended the 30th of June last, and to elect two Directors and one Auditor in the place of those who go out by rotation, but who are eligible to be re-elected.
Notice is hereby also given, that the Transfer Books of the Company will be closed on the 16th and re-opened on the 28th inst.
By order of the Court of Directors,
FREDERIC LANE LINGING,
Secretary.
Chief Office: No. 11, George Yard,
Lombard Street, London, E.C.,
Sept. 7, 1893.

NOW READY.
GAS AND WATER CO.'S DIRECTORY, 1893.
Seventeenth Annual Issue, 5s.
GAS-WORKS STATISTICS, 1893.
Fifteenth Annual Issue, 3s. 6d.
WATER-WORKS STATISTICS, 1893.
Thirteenth Annual Issue, 2s. 6d.
Handsomely Bound in One Vol., Price 10s.
LONDON: HAZELL, WATSON, & VINEY, Ltd.,
1, CREED LANE, E.C.

To effect a great saving in
GAS-FURNACES use our
Special Derbyshire **GANNISTER BRICKS.**
ADDRESS
JAMES WHITE & Co., Limited,
ALBERT WORKS, WIDNES.

MEIKLEJOHN'S PATENT
Improved Slide-Valve Anti-Dip.
Is perfectly reliable in action, and requires no attention. Has all the advantages of the Dip and Anti-Dip combined.
Is cheap and easily fixed to any form of main.
Will be found the most efficient appliance of the kind yet introduced.
Further particulars and price from
C. MEIKLEJOHN,
GAS-WORKS, RUGBY.
(Late N. MEIKLEJOHN, Longwood.)

HOLMSIDE GAS COALS.
(Wrought out of Holmside and South Moor Collieries.)

PRESENT production 4000 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16¼ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of nearly
600,000 Tons per Annum.
Full particulars on application to
MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-ON-TYNE.

ROBERT MARSHALL,
CANNEL COAL MERCHANT,
97, WELLINGTON STREET, GLASGOW.
Prices and Analysis of all the Scotch Cannels on application.

PRICE'S PATENT COKE & COAL BARROW

effecting a great saving of time labour, and expense.
For particulars, price, &c., apply to Mr. E. PRICE, Inventor and Patentee, 22, Alwyne Road, Canonbury, LONDON, N.
Prices are Reduced.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.
QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

CAST-IRON PIPES
FOR GAS AND WATER.
Pipes, One to Six inch Bore, kept in Stock. Also a very large assortment of all sizes of Bends, T-pieces, and Specials ready for despatch on receipt of Order.
VALVES
FOR GAS, WATER, AND STEAM.
TELEGRAMS: "PIPES GLASGOW."
WM. MACLEOD & CO.,
56, ROBERTSON STREET, GLASGOW.

THOMAS TURTON AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS,
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.
London Office:
90, CANNON STREET, E.C.

THE SILICA FIRE-BRICK COMPANY,
OUGHTIBRIDGE, near SHEFFIELD,
MANUFACTURE
SILICA BLOCKS, BRICKS, AND CEMENT
OF SUPERIOR QUALITY
FOR GAS-FURNACES.
Trade Mark: "SILICA."
These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their
GREATER DURABILITY
Strongly recommended where EXCESSIVE HEATS have to be maintained.

TROTTER, HAINES, & CORBETT,

Brettell's Estate

FIRE-CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

Proprietors of

BEST GLASSHOUSE POT & CRUCIBLE CLAY.

SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cubic feet.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For prices, f.o.b. Ship or Delivered by Rail, apply to

THE WALLSEND & HEBBURN COAL COMPANY, LTD.,
B Lombard Street,
NEWCASTLE-ON-TYNE.

W. RICHARDSON, Fitter.

JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

Wenlock Iron Wharf, 21 & 22, Wharf Road,

CITY ROAD, LONDON, N.

Manufacture and keep in Stock at their Works

(also large stock in London)

PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts, and covers, and rendering leakage impossible.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE

BOGHEAD CANNEL.

Yield of Gas per ton . . . . . 13,155 cub. ft.
Illuminating Power . . . . . 38·22 candles.
Coke per ton . . . . . 1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·3 candles.
Coke . . . . . 70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·3 candles.
Coke . . . . . 73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,
COAL OWNERS, NEWCASTLE-ON-TYNE;
OR
E. FOSTER & CO.,
21, JOHN STREET, ADELPHI, LONDON, W.C.

NIDDRIE CANNEL

A FIRST-CLASS CANNEL COAL,

Yielding a large volume of rich Gas, and fully 60 per cent. of first-class Coke.

FOR ANALYSIS, PRICE, AND ALL OTHER PARTICULARS, APPLY TO

The Niddrie & Benhar Coal Co., Ltd.,
15, HANOVER STREET,
EDINBURGH.

Telegrams: "BENHAR, Edinburgh."

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,

COUNTY OF DURHAM.

Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.,

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton . .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Ipswich Gaslight Company, Devonport Gas Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY,
LIMITED,
Newcastle-on-Tyne.
W. H. PARKINSON,
FITTER.

T. B. KITTEL, SHEFFIELD.

CONTRACTS FOR SUPPLIES OF ANY OF THE PRINCIPAL

ENGLISH & SCOTCH CANNELS.

REAL SILKSTONE GAS COAL

ANALYSIS AND PRICES ON APPLICATION.

T. B. KITTEL, SHEFFIELD.

AUG. KLÖNNE,

DORTMUND (GERMANY).

REGENERATIVE FURNACES.

Unsurpassed in Efficiency, Economy, Durability, and Easy Working.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

HUNTER'S

OXIDE OF IRON.

JAMES HUNTER, LESSEE, MINER, AND SHIPPER OF NATURAL IRISH BOG ORE.

This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed.

Samples and Prices on application.

11, BAY STREET, PORT GLASGOW.

Telegrams: "HUNTER PORT GLASGOW."

Established 1872.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON AND COAL COMPANY, Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

The Analysis made by Messrs. J. and H. T. Pattinson, Public Analysts for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a Working Analysis made of these Coals by the Tudhoe and Sunderland Bridge Gas Company:—

[COPY.]

TUDHOE AND SUNDERLAND BRIDGE GAS COMPANY.

Tudhoe Gas-Works,
Spennymoor,
8th June, 1893.

Messrs. The
WEARDALE IRON & COAL COMPANY, LTD.

GENTLEMEN,

For the last two months we have used your **THORNLEY GAS COAL** exclusively at these gas-works; and I have pleasure in herewith giving you the actual results obtained during the trial.

Yield of Gas per ton: 10,300 cubic feet.
Yield of Coke: 13½ cwt.
Illuminating Power of Gas, average of a series of tests, **17 Sperm Candles.**
The Coke was of excellent quality.
The following is a complete ultimate Analysis of the Coal.

	Per Cent.
Carbon	83·128
Hydrogen	5·116
Oxygen	7·401
Nitrogen	0·585
Sulphur	0·620
Ash	3·130
Water	0·020
	100·000

Analysis of the Coke.

Carbon	93·31
Sulphur	0·61
Ash	5·00
Moisture	1·08
	100·00

I am, Gentlemen,
Yours truly,
A. B. COWAN,
Manager.

For Price, &c., apply to the

WEARDALE IRON & COAL Co. Ld.
QUAYSIDE, NEWCASTLE-ON-TYNE.

Wrought-Iron

And Fittings and Accessories.

LAMBERT BROS., WALSALL,
MANUFACTURERS OF
WROUGHT-IRON TUBES & FITTINGS for GAS, WATER, & STEAM,
BRASS GAS-FITTINGS, GAS-VALVES, STEAM & WATER VALVES, TOOLS, &c., AND OF
WARNER'S PATENT MARKET GAS STAND-PIPE.
LONDON: LAMBETH BRASS & IRON CO., Short Street, LAMBETH.

G. WALLER & CO.'S NEW PATENT GAS EXHAUSTER

MADE WITH FOUR BLADES,

To pass 300,000 Cubic Feet per Hour, with or without Engine combined.

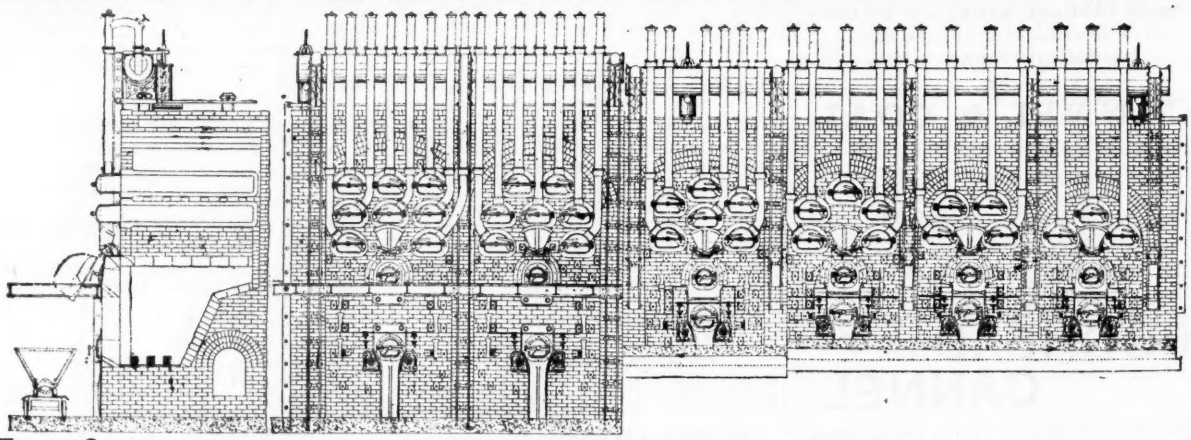
IN USE AND ON ORDER FOR OVER 100 WORKS,
AND EQUAL TO
5,340,000 CUBIC FEET PER HOUR.

SPECIAL ADVANTAGES:—

The Four-Blade Exhauster **PASSES 50 PER CENT. MORE PER REVOLUTION** than any One or Two Blade Exhauster.
It takes 27 per cent. less power than any Two-Blade Exhauster.
It gives a steadier Gauge than any other Exhauster.
One of our 150,000 feet per hour Patent Four-Blade Exhausters passes continuously **180,000** cubic feet per hour, driven by a **12-INCH STEAM CYLINDER.** No other Maker can give a similar result.
Model of Patent Exhauster sent for inspection.
Oldest Makers of Beale Exhausters for over 300 Works.
Patent Compensating Steam Governor, Special Tar and Liquor Pumps, Gas-Valves.
Washer-Scrubbers, with **WOOD CLUSTERS,** and Tar Extractor combined.

PHŒNIX ENGINEERING WORKS,
PARK STREET, SOUTHWARK, LONDON, S.E.

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE ADAPTED TO THE REQUIREMENTS OF ALL GAS COMPANIES AND GAS CORPORATIONS, AND HAVE ALREADY BEEN EXTENSIVELY ADOPTED. THEY ARE ERECTED UPON BOTH THE WORKING-STAGE AND SHALLOW-CHAMBER SYSTEMS, AND EQUALLY SATISFACTORY RESULTS ARE GUARANTEED IN BOTH CASES.

THE SETTINGS HAVE ATTAINED TO A MEASURE OF SUCCESS AND POPULARITY QUITE UNEQUALLED BY THAT OF ANY OTHER WITHIN THE SAME SPACE OF TIME. THE WORKING RESULTS OBTAINED, AND THE GENERAL SATISFACTION GIVEN, ARE DECLARED IN EVERY CASE TO EXCEED, AND IN MOST CASES CONSIDERABLY EXCEED, THE PATENTEE'S GUARANTEE. THE CONSTRUCTION AND WORKING OF THE PATENT PRODUCER AND THE PATENT CHARGING APPARATUS FOR SAME ARE ABSOLUTELY UNIQUE AND UNRIVALLED, AND ARE THE DELIGHT OF EVERY STOKER; WHILE IN EVERY OTHER PARTICULAR THEY SECURE THE HIGHEST RESULTS ATTAINABLE BY ANY REGENERATIVE SYSTEM, AND AT A MINIMUM OF COST.

Drawings and Specifications are furnished for the complete erection of Ovens, with or without Retort and Bench Mountings, or complete erection undertaken if required, and carried out by specially Trained Workmen.

Further particulars may be obtained on application to the Patentee's Agents: C. M. HAMILTON, 5, Stewart Street, Shawlands Glasgow; J. E. FISHER, Stourbridge, and from R. F. HISLOP (son of Patentee), Gas-Works, Paisley.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine quâ non* TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED, AND AFFORDING THE HIGHEST SATISFACTION.

SPENT LIMES NO LONGER WASTE PRODUCTS

Under G. R. HISLOP'S PATENTS.

All Spent Limes are most effectually, economically, and continuously recovered at from one-third to one-half the cost of New Lime. The results are a surprise to all who have inspected the process, and are entirely satisfactory to all now using it.

Descriptive Pamphlets and Terms from Agents as above.

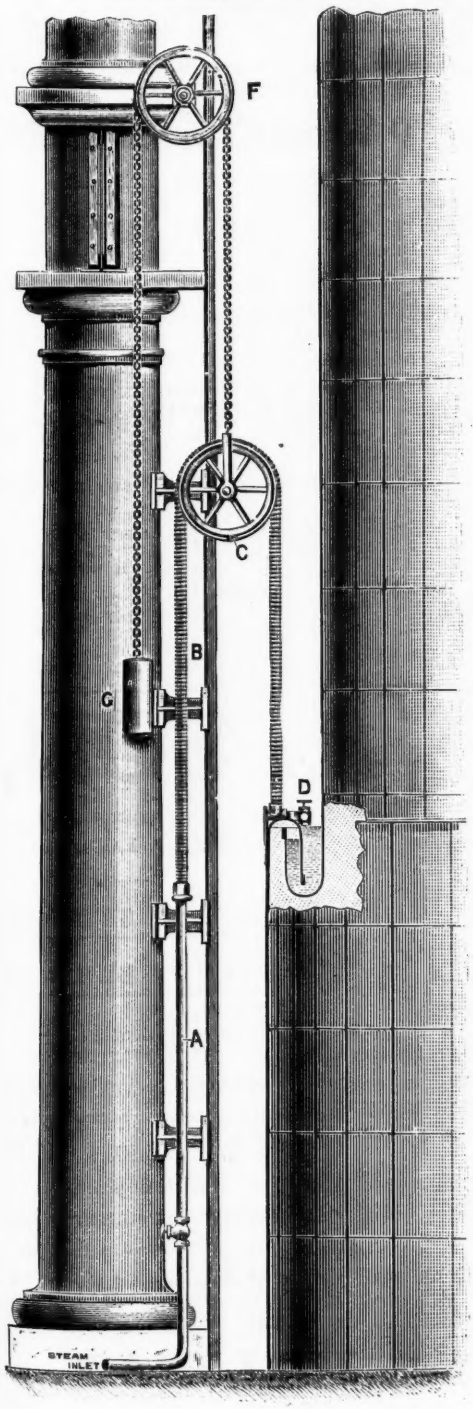
WINTER, 1893-94

EVERY TELESCOPIC GASHOLDER

SHOULD BE FITTED WITH

CUTLER'S PATENT FREEZING PREVENTER.

Which removes all danger arising from Formation of Ice in Cups, and has been fitted to the following and other important Gasholders:—



LONDON—Beckton . .	247 ft. by 45 ft. . .	4 Lifts.
„ Kensal Green	247 ft. „ 55 ft. . .	3 „
„ Bethnal Green	197 ft. „ 50 ft. . .	3 „
„ Nine Elms. .	149 ft. „ 29 ft. . .	4 „
AMSTERDAM I.C.G.A. .	150 ft. „ 25 ft. . .	3 „
„ „ .	150 ft. „ 25 ft. . .	3 „
HANOVER „ .	154 ft. „ 38 ft. . .	3 „
VIENNA „ .	204 ft. „ 41 ft. . .	3 „
„ „ .	60 ft. „ 18 ft. . .	2 „
FRANKFURT „ .	80 ft. „ 25 ft. . .	3 „
BROMLEY, KENT . .	120 ft. „ 32 ft. . .	3 „
HULL (Kingston) . . .	71 ft. „ 20 ft. . .	3 „
HERTFORD	60 ft. „ 18 ft. . .	2 „
HORNSEY, Middlesex .	111 ft. „ 35 ft. . .	3 „
HALIFAX	184 ft. „ 31 ft. . .	3 „
„	140 ft. „ 30 ft. . .	3 „
KING'S LYNN	60 ft. „ 20 ft. . .	2 „
MANCHESTER . . .	150 ft. „ 35 ft. . .	3 „
RICHMOND	110 ft. „ 29 ft. . .	3 „
„	85 ft. „ 24 ft. . .	3 „
TOTTENHAM	150 ft. „ 32 ft. . .	3 „
STAFFORD	107 ft. „ 25 ft. . .	2 „
WARWICK	80 ft. „ 20 ft. . .	2 „
GT. YARMOUTH . . .	95 ft. „ 30 ft. . .	2 „

COPENHAGEN, &c., &c.

S. CUTLER & SONS,

MILLWALL, LONDON.

ALEX. C. HUMPHREYS, M.E.,
General Superintendent & Chief Engineer,
The United Gas Improvement Company, U.S.A.

A. G. GLASGOW M.E.,
Late General Inspector,
The United Gas Improvement Company, U.S.A.

HUMPHREYS & GLASGOW,

Contracting Engineers for Water Gas Plant,
9, Victoria Street, London, S.W.

WILLIAM INGHAM & SONS,

Incorporated with the Leeds Fire-Clay Company, Ltd.,
WORTLEY FIRE-CLAY WORKS
Near LEEDS,

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

PATENT
MACHINE-MADE GAS-RETORTS.

GAS AND WATER PIPES
AND
CASTINGS OF EVERY DESCRIPTION.

MANUFACTURED BY THE

CLAY CROSS COMPANY,
CHESTERFIELD.

TRADE	TELEGRAMS:	LONDON AGENTS:
O X O	"JACKSON"	BECK & Co.,
MARK.	CLAY CROSS.	130, ST. SUFFOLK ST., S.E.

GODDARD, MASSEY, & WARNER'S
IMPROVED
Sulphate of Ammonia Apparatus.

The most successful and approved Apparatus known up to the present time.

FOR REFERENCES, PARTICULARS, TESTIMONIALS, AND PRICE APPLY TO

GODDARD, MASSEY, & WARNER,
ENGINEERS,
NOTTINGHAM.

The Apparatus has been supplied to the following Firms—

BURT BOULTON, & HAYWOOD, SILVERTOWN, and ELING.
CHANCE BROTHERS, OLDBURY (Four Apparatus).
RUNCORN SOAP & ALKALI CO., Limited, RUNCORN.
NETHAM CHEMICAL CO., Limited, BRISTOL.
ANIMAL CHARCOAL CO., Limited, SHADWELL.
WM. BUTLER & CO., BRISTOL.
KEMPSON & CO., Pye Bridge.

And to the following Gas Companies and Corporations—

ILKESTON.	BURY.	CHORLEY.
WIDNES.	BRIGHOUSE.	WHITEHAVEN.
HALIFAX.	MARKET HARBRO'.	CHESTER.
ALTRINCHAM.	PRESCOT.	SOUTH SHIELDS.
DENTON.	SOWERBY BRIDGE.	LEEK.
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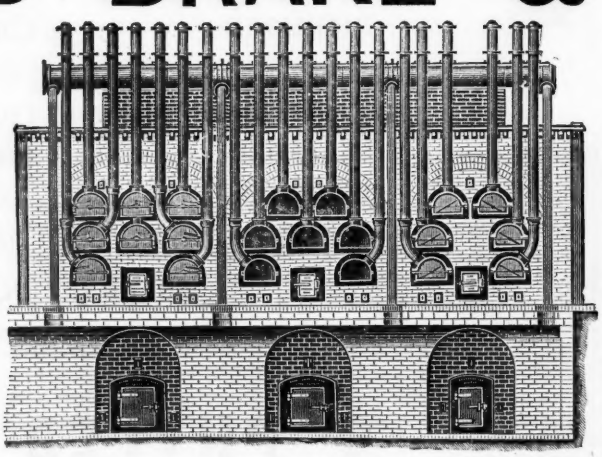

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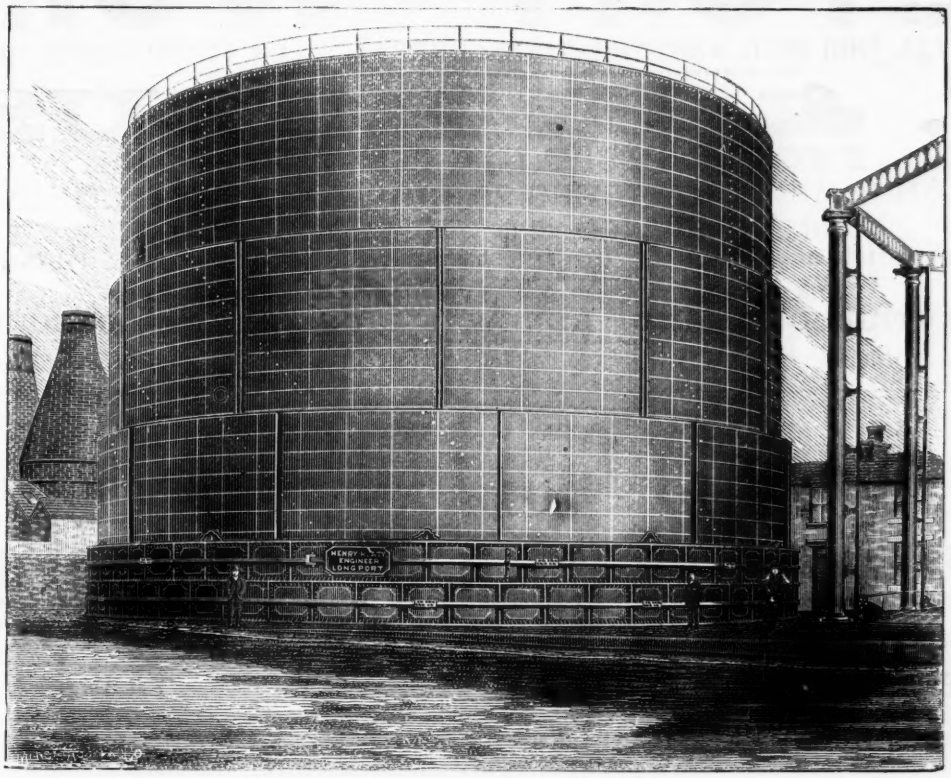

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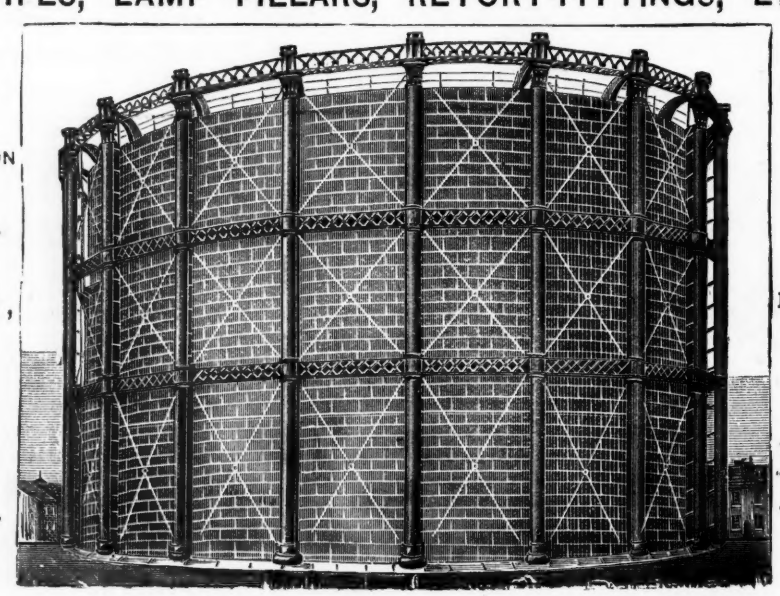

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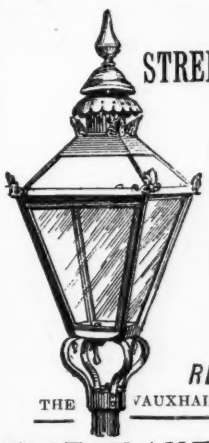

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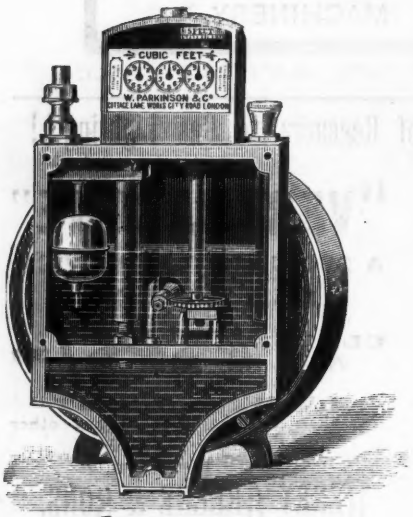

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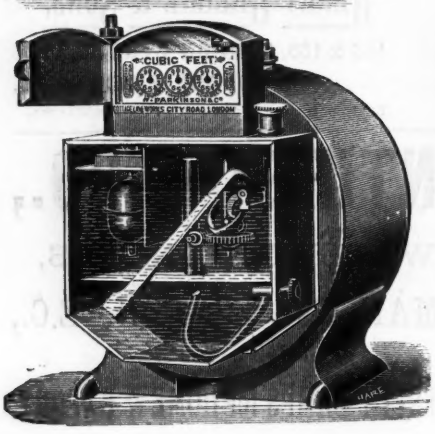

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See also Advt. p. 522.

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